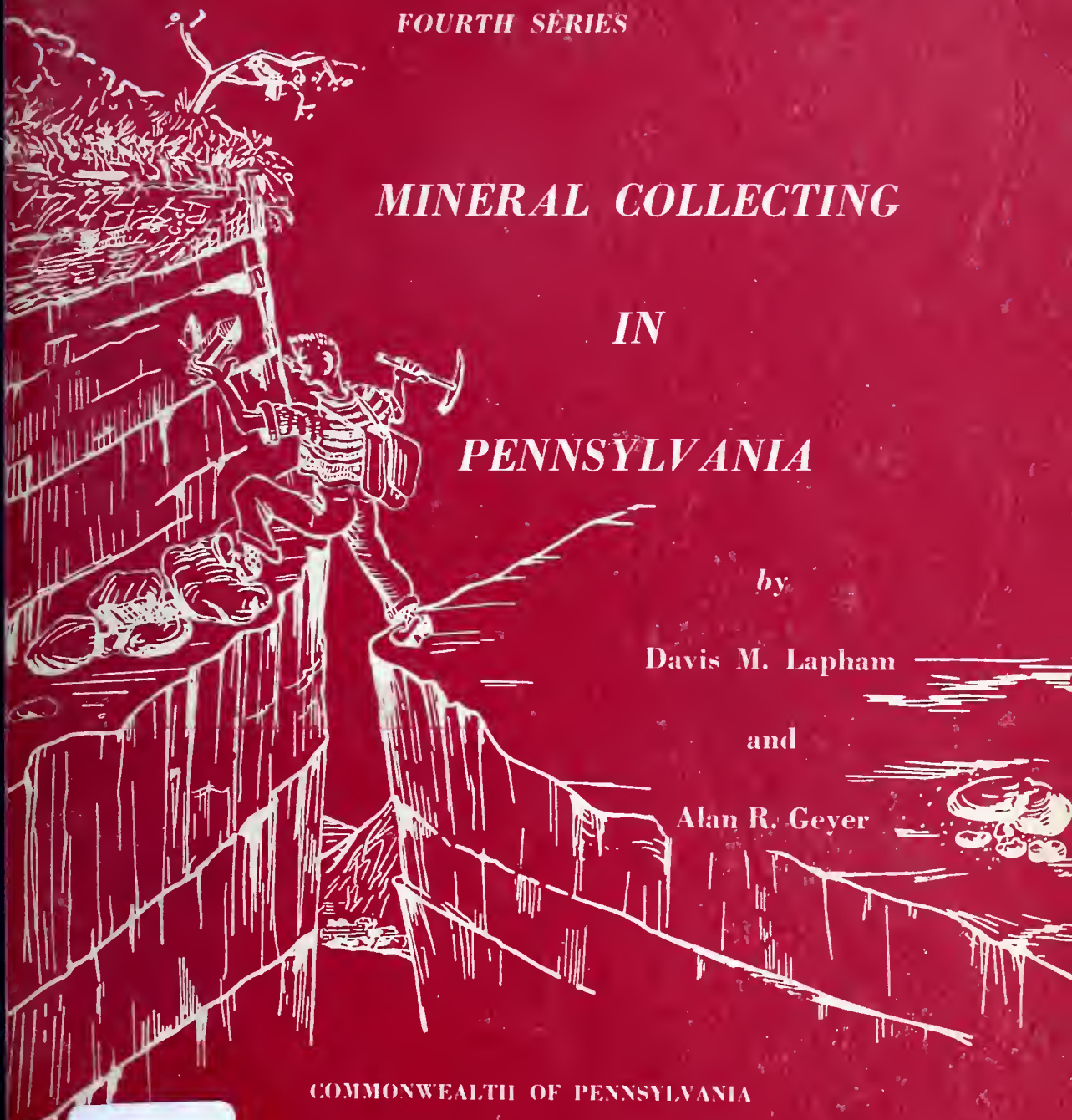
BULLETIN G 33

PENNSYLVANIA GEOLOGICAL SURVEY

FOURTH SERIES



MINERAL COLLECTING IN PENNSYLVANIA

by

Davis M. Lapham

and

Alan R. Geyer

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF INTERNAL AFFAIRS

Genevieve Blatt, *Secretary*

TOPOGRAPHIC AND GEOLOGIC SURVEY

Carlyle Gray, *State Geologist*

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MINERAL COLLECTING IN PENNSYLVANIA

INTRODUCTION

In recent years, mineral collecting has become a hobby for an increasingly large number of people. The Pennsylvania Geological Survey hopes that this booklet will help to stimulate this interest in mineral collecting by providing recent information on good collecting localities. We are not attempting an exhaustive treatment of Pennsylvania's mineral occurrences, such as Samuel G. Gordon's report, "The Mineralogy of Pennsylvania", published in 1922. Rather, we have selected a small number of localities based on the abundance and variety of minerals which can be found there today. Many old and famous localities are now 'barren' as far as the "rockhound" is concerned. These have been excluded. On the other hand, new occurrences of significance have been discovered, and are described here. Additional localities will be published in the "Penn Prospector" column of the "Internal Affairs Monthly Bulletin" and will be added to later editions of this booklet.

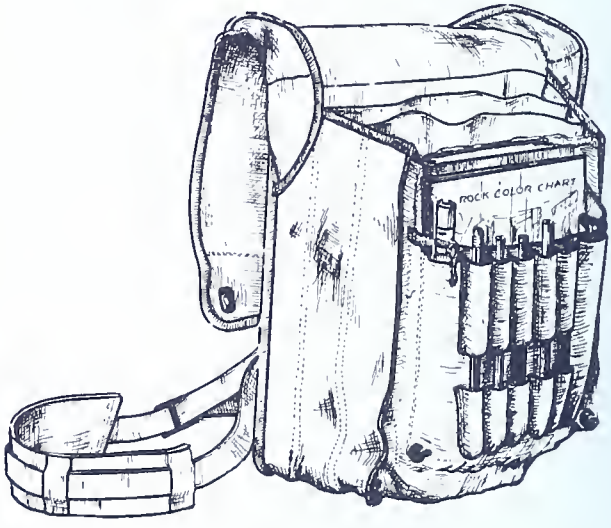
Since mineral collecting and the science of mineralogy, are a part of the more inclusive science of geology, we have included brief summaries of the geology of each occurrence. Definitions of some geological terms and processes have been included to help make this geology more useful and meaningful to the mineral collector.

There is one warning we would like you, the rockhound, to heed. Ask permission from the owners of the land, or from the quarry and mine operators, before entering to collect. This will ensure goodwill between you and the land owners. In the case of operating quarries or mines, it will also add to

your safety, since supervision of collectors is often required under company policy. In the past, the abuses of inconsiderate collectors have caused many excellent localities to be closed to the public. Do not be a trespasser.

MINERAL COLLECTING

The study of rocks and minerals is an important part of the science of geology. These same rocks and minerals which we see each day along the road, in our garden, and when we go for a hike in the woods, are so familiar that in many cases we do not bother to learn even their names. And just as each has a different name, so does it have a distinct 'personality'. If from this day on you will pick up these rocks and minerals, learn their names, and whatever else you can about them, you will find that the earth we live on is a fascinating world. Join the ranks of the thousands of "rockhounds" who have discovered that mineral collecting is an exciting hobby.



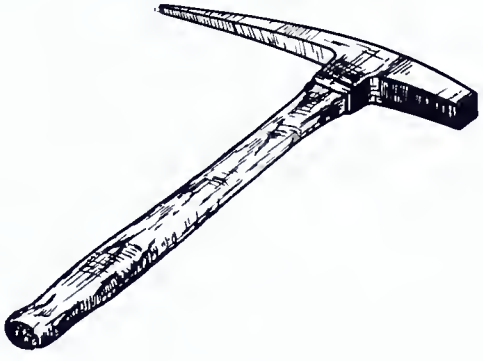
The surface of the earth is made up of MINERALS - more than 1800 different kinds. Many of these are rarely seen because they are buried deep within the crust. Without these minerals, both the soft and the resistant ones, there would be no broad, majestic, river valleys or towering mountains and rolling hills. Even the soils which underlie dense forest growths and undulating farm lands are made up of mineral fragments weathered from rocks.

The world of man-made articles relies on the elements obtainable from minerals. In glass making, from the commonest bottle glass to the most expensive, decorative, colored

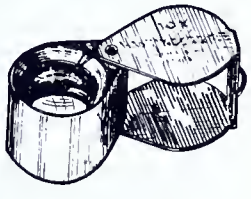
glassware, the mineral quartz is the source for silicon and oxygen. The metals of cars, steel-girdered buildings, and complicated technical machinery are possible only through the efforts of men tunneling, scraping, and digging into masses of rock in search of valuable iron-rich minerals which they may contain. Every step of our modern existence is aided by the knowledge and exploitation of mineral resources. Every new technological advance cries out with the need for more minerals. Often, it is the amateur collector or the prospector who finds them.

As GEMS, minerals have captured imaginations from the earliest civilizations down to the present time. In combining beauty with rarity, man has never excelled nature's own mineral production.

The unique shapes, variety of color, and individuality of minerals initiated the intriguing hobby of mineral collecting. It began many thousands of years ago and has grown today to a major hobby in which the whole family often participates. Minerals are within walking or driving distance of everyone.



Thanks to nature's generosity the cost of collecting them is no more than a little time and gasoline. Many minerals remain waiting to be discovered; the collector has an opportunity to be the first human being to see that particular crystal.



The rocks and minerals you will find at the following localities are only a beginning, an appetizer, to what we hope will become both a fascinating and educational exploration into a scientific field which contains all the romance of a strange adventure.

USE OF TOPOGRAPHIC MAPS IN MINERAL COLLECTING

General

The first necessity for a mineral collecting expedition is a knowledge of how to get there. The second is a knowledge of where to look. If the mineral collector can understand the information given on a topographic map, the location of a mineral site, designated by quadrangle and rectangle, will pose no problem. An example is the locality for limonite pseudomorphs after pyrite found near Columbia in Lancaster County, described in this report. If the only description of its location were given as "about three miles east of Columbia, Pennsylvania", the anxious mineral collector might traverse many weary miles and spend many discouraging hours before he arrived, if ever, at the collecting locality. However a topographic map not only narrows down the area of search, but it also contains the shapes and names of land features by which an exact pin-pointing of the locality may be made.

Topographic Maps and How to Read Them

A topographic map is the representation of the relief, or 'ups and downs', of the land surface, along with roads, houses, political boundaries, and geographic place names, - such as Chestnut Hill at the limonite pseudomorph locality. One topographic map, regardless of the area it covers, is referred to as a quadrangle. It is subdivided into nine equal areas, called rectangles. Brown contour lines on a topographic map represent lines of equal elevation, and tell us where the hills, valleys, and flat lands are. The more closely spaced these lines are, the steeper is the slope.

The topographic maps of the U. S. Geological Survey are printed in color; culture in black, contours in brown, and water in blue. Cultural features mean the works of man, such as houses, roads, railroads, county boundary lines, and dams. On the mineral collecting locality maps in this booklet, taken from U. S. Geological Survey maps, the colors are not shown, but you should not have much difficulty in telling culture and

rivers apart. A key to the conventional signs used on the map is printed on the reverse side of some U. S. Geological Survey maps. A booklet describing topographic maps and symbols may be obtained free by writing, Map Information Office, U. S. Geological Survey, Washington, D. C.

In the actual making of a topographic map the surveyor first decides on a convenient scale. He then finds the elevation of every point where the slope of the land changes and notes these on the map, in the field. A contour interval is then decided upon; for example, 20 feet, as is the case in most topographic maps of Pennsylvania. All points then 20 feet above sea level will be connected by a continuous line, called a contour. The same will be done for all points 40 feet above sea level, and so forth, until the entire map is covered with contours.

When you become accustomed to reading contour maps, you can quickly read the irregularities of the surface, almost as well as if the map were a three-dimensional model.

In general, two of the following three types of scales are represented on most quadrangles. The three are, fractional, verbal, and graphic.

The fractional scale is a ratio such as 1:62,500 or 1 :24,000. It means that one linear unit (such as one inch) on the map equals 62,500 or 24,000 linear units on the earth's surface. Thus one inch on the map represents 62,500 inches or 24,000 inches on the earth's surface. Note that 24,000 inches equals 2000 feet and that 62,500 inches equals 5208 feet, or nearly one mile.

The verbal scale is probably more familiar than any of the other scales. It is expressed as one inch equals approximately one mile (1:62,500) or one inch equals 2000 feet (1:24,000).

The graphic scale consists of lines that are divided into units of miles and kilometers. It may be used directly in

measuring distances on the map with a ruler.

Wherever possible, maps on a scale of 1:24,000 (7-1/2 minute quadrangles) have been used to locate mineral localities in this booklet. This scale is more than twice as large as the 1:62,500 (15 minute quadrangle) and shows a smaller area in much greater detail. Quarries, mines, open-pits, deep gullies, and roadcuts are effectively outlined on this series of maps. Unfortunately they are not available for all of Pennsylvania, but the southeastern part of the state is completely covered. An index of topographic maps available for Pennsylvania may be obtained free of charge from the Map Information Office, U. S. Geological Survey, Washington 25, D. C. Individual maps may also be purchased from the U. S. Geological Survey or from an authorized local dealer.

The first use a "rockhound" will have for a topographic map is to locate himself or to locate a particular place. Of the many methods of describing locations that are used with different types of maps and in different areas, only one will be discussed here.

The boundaries of all U. S. Geological Survey topographic maps or quadrangles are parallels of latitude and meridians of longitude. The exact degrees of each are given on each corner on all quadrangle maps. In addition to these corner markings there are tick marks for each five minutes of latitude and longitude in the case of the 15 minute quadrangles and for every two and one-half minutes of latitude and longitude in the case of the 7-1/2 minute quadrangles. These marks, or ticks, subdivide the quadrangle into nine convenient rectangles for ready reference. They can be called the northwest rectangle, the north-central rectangle, the northeast rectangle, the west-central rectangle, the central rectangle, the east-central rectangle, the southwest rectangle, the south-central rectangle, and the southeast rectangle. Also, if a greater degree of accuracy is desired, each individual rectangle can further be subdivided into four or even nine more divisions, such as the original nine, and so on.

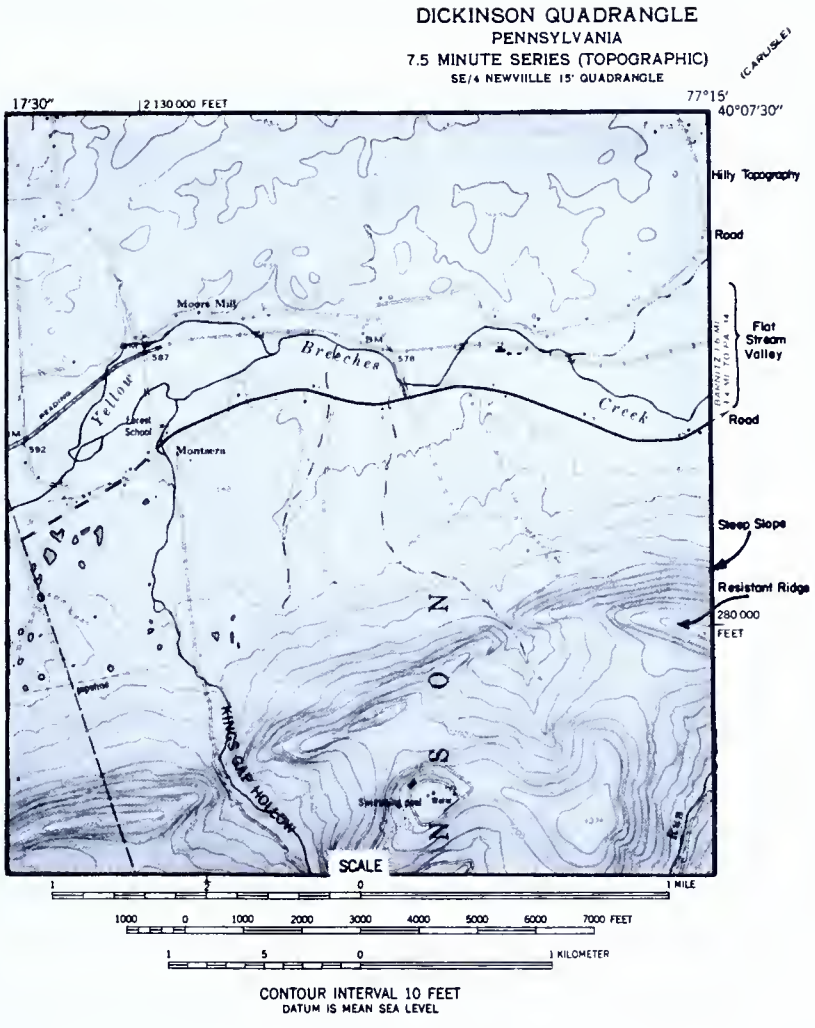


Figure 1. A part of a topographic map showing typical features mentioned in text.

The location descriptions given for the following mineral collecting localities use this system of pin-pointing deposits. In Figure 1 an example is given of the northeast rectangle of the Dickinson 7-1/2 minute quadrangle. The top of the map, which is always the North direction, illustrates gently rolling hills. In the center of the area, there is a flat flood plain along the Yellow Breeches Creek. To the south is a high ridge with a steep northern slope. Note how the contours illustrate these three topographic expressions.

In addition to the topographic map descriptions, a small map showing the exact location of each collecting locality is given. These have been redrafted from topographic quadrangles, omitting the contour lines and adding route numbers for the sake of clarity.

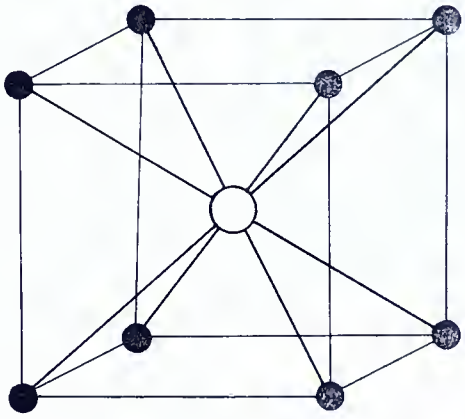
MINERALS

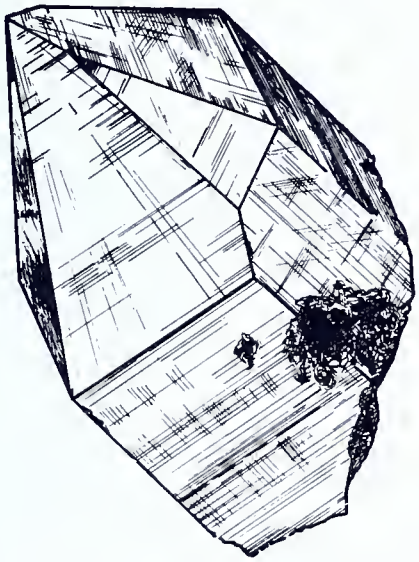
Definition

A mineral is usually formed by natural inorganic processes, has either a fixed chemical composition or a composition which is variable within narrow limits, and generally possesses a characteristic atomic structure. Minerals are usually formed by natural means but also have been reproduced by man; especially gems and industrial minerals, for example diamond, quartz, and corundum. These are called synthetic minerals. Minerals again are usually formed by inorganic processes but may also be formed by organic ones as in the case of phosphate minerals formed from bird guano and the carbonates of clam shells. The more mineralogists study the exact chemical composition of minerals the fewer are found which have the same fixed chemical composition. A characteristic atomic structure means that minerals have a regular arrangement of atoms beneath their surface; this regular arrangement results in the growth of crystals with definite shapes.

Crystals

A mineral may be identified by certain properties or characteristics that it possesses. Some minerals are easily identifiable while others require careful examination and often chemical, thermal, or X-ray analysis. One of the simplest means of identification is by an examination of crystal form. A crystal has a consistent shape bounded by planar surfaces (faces) which are an outward expression of the internal arrangement of atoms. Different crystal faces have different atoms or a different arrangement of atoms beneath them which gives rise to surfaces of varying shapes and sizes. Crystals are formed by - 1. crystallization from solution, 2. fusion, or 3. vapor. An example of crystals formed from solution would be salt dissolved in water and then, by evaporation of the water, the salt will separate out (precipitate) and definite crystals result. The most familiar example of crystallization by fusion is the formation of aggregates of ice crystals under the pressure of freezing water. The third method of crystal formation, by vapor, is characterized by the formation of snow flakes. This happens when air, containing large amounts of water vapor, is quickly cooled and snow crystals form directly from the vapor.





Crystal forms are described by such common names as cube and pyramid, and by less common names such as prism (an elongated form), octahedron (8-sided form), dodecahedron (12-sided form). and rhombohedron (6-sided form whose faces are parallelograms). Well-developed crystals, however, are not common because conditions of growth must be just right for their formation. In many cases the crystals found will be distorted and probably have a combination of several forms. Often two or more crystals will be intergrown; that is, the crystal of one will look as if it had grown out of the side of another. These are called twins. Some of these terms describing crystal shapes will be mentioned in this booklet when they are of special interest to mineral collectors.

Mineral Associations

Nature is generally quite orderly in everything she does and the occurrence of rocks and minerals is no exception. Every mineral is made up of one or more elements like chromium, oxygen, silicon, nickel, etc. Certain of these elements occur together in nature, not always in the same mineral, but in different minerals, and are then found by the collector, usually in association with each other. Sometimes this association helps in identifying a mineral by excluding many possibilities. This fact is also very important to the collector because when he travels, for example to a galena locality, he also will expect to find the mineral sphalerite as well as carbonates and sulfates of both lead and zinc. In addition to certain minerals usually occurring together, they also are formed in particular kinds of rocks. Native gold for instance is very rarely found in limestone but often found in quartz. Nickel minerals again would not be expected in sandstones and shales but rather in basic igneous rocks such as gabbro, norite, and dunite. The following table is presented for the beginning mineral collector so that he may better understand these mineral associations and the host rocks in which they occur.

MINERAL AND ROCK ASSOCIATIONS

Mineral	Associated Mineral	Enclosing Rock
Chromite	Olivine	Ultrabasic
	Magnesite	Igneous rocks:
	Serpentine	Peridotite
	Talc	Dunite
	Magnetite	Serpentinite
	Enstatite	
Galena	Silver	Sedimentary rocks:
	Sphalerite	Limestone
	Pyrite	Dolomite
	Barite	Chert
	Anglesite	Quartz or
	Cerussite	Carbonate veins
Magnetite	Pyrite	Metamorphic rocks:
	Chalcopyrite	Schist
	Pyrrhotite	Gneiss
	Chromite	Igneous rocks:
	Ilmenite	Diabase
		Ultrabasic
		Pegmatite
		Granite
Quartz crystal	Feldspar	Sedimentary rocks:
	Calcite	Sandstone
	Tourmaline	Limestone
	Beryl	Igneous rocks:
	Mica	Pegmatite
Calcite crystal	Aragonite	Sedimentary rocks:
	Dolomite	Limestone
	Pyrite	Igneous rocks:
	Siderite	Pegmatites
	Quartz	
	Chalcopyrite	
Beryl	Tourmaline	Metamorphic rocks:
	Quartz	Schist
	Mica	Igneous rocks:
	Feldspar	Granite
		Pegmatite

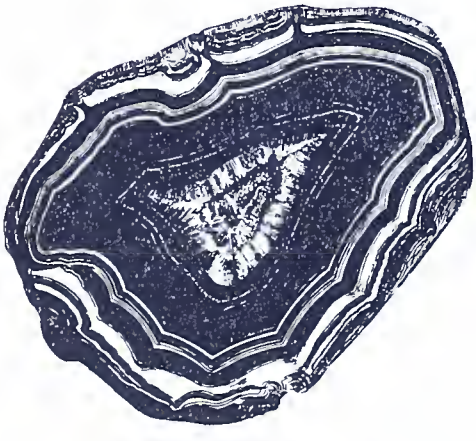
MINERAL AND ROCK ASSOCIATIONS (contd)

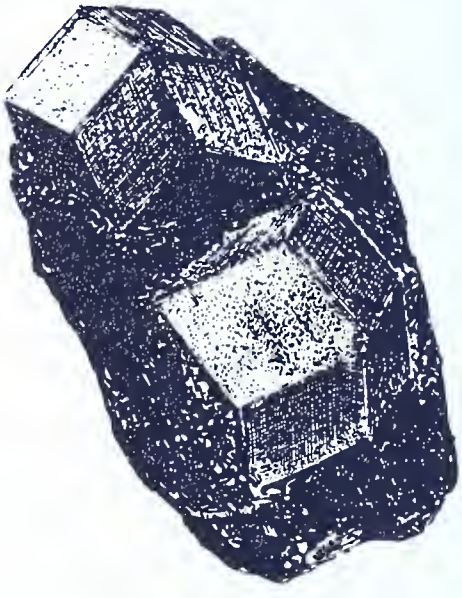
Mineral	Associated Mineral	Enclosing Rock
Limonite	Pyrite Manganese minerals Marcasite Hematite Goethite	Sedimentary rocks: Impure limestone Shale Sandstone Iron-rich igneous rocks
Native Copper	Malachite Azurite Limonite Zeolites	Sedimentary rocks: Conglomerate Igneous rocks: Greenstone Andesite Basalt
Mica	Quartz Feldspar Chlorite	Igneous rocks: Granite Pegmatite Metamorphic: schists Sedimentary rocks:shale
Graphite	Calcite Diopside Garnet Mica	Metamorphic rocks: Schist Marble Gneiss
Carnotite	Autunite Gummite Carbon Vanadium and Copper minerals	Igneous rocks: Pegmatite Sedimentary rocks: Sandstone Shale
Feldspar	Quartz Chlorite Mica Calcite	Igneous rocks: Pegmatite Granite Sedimentary rocks: Sandstone
Zeolites	Chlorite Calcite Aragonite	Igneous rocks: Basalt and Diabase

MINERAL AND ROCK ASSOCIATIONS (contd)

Mineral	Associated Mineral	Enclosing Rock
Garnets	Vesuvianite Mica Kyanite Hornblende Staurolite Chlorite Tourmaline Epidote	Metamorphic rocks: Schists Gneisses Metabasalt and Metadiabase Igneous rocks: Gabbro
Clays	Mica Chlorite Feldspar Quartz	Sedimentary, Igneous and Metamorphic
Talc	Chlorite Magnetite Ankerite Serpentine Pyrophyllite Mica	Igneous rocks: Ultrabasics and Serpentine Metamorphic rocks: Altered dolomite

SELECTED MINERAL COLLECTING LOCALITIES



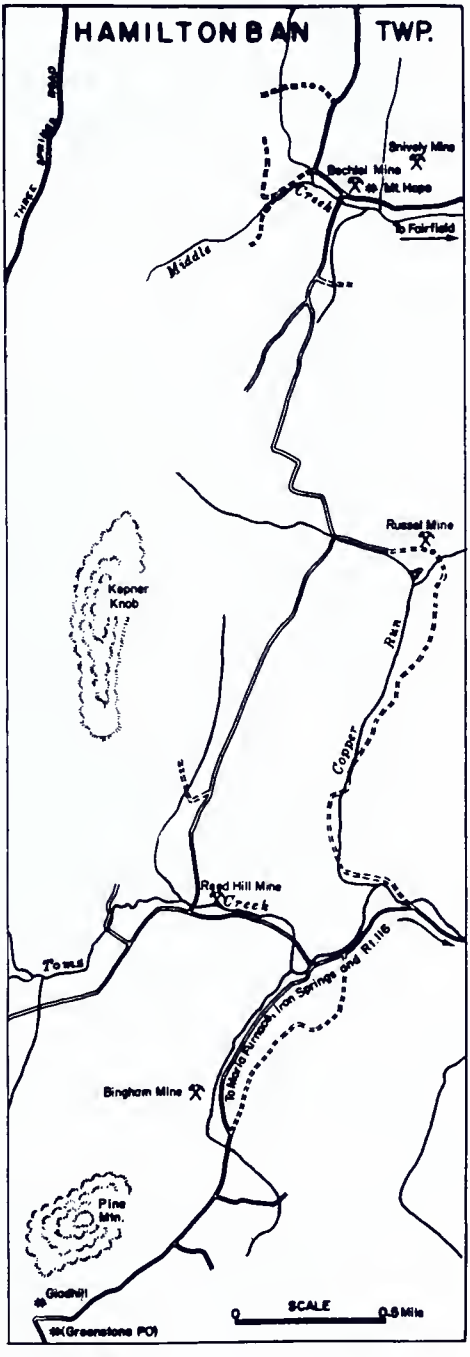


ADAMS COUNTY

Native Copper Mineral Locality

Location:

The best native copper mineral collecting localities in Pennsylvania are located in southwestern Adams County. The individual abandoned mines are located in the central and south-central rectangles of the Iron Springs 7-1/2 minute quadrangle. The exact location of the mines is given below and shown on the sketch map.



Snively Mine: located approximately 1/4 mile northeast of Mount Hope, on the east side of the mountain; Mount Hope is located in the center rectangle of the Iron Springs quadrangle.

Bechtel Mine: located at the town of Mount Hope.

Russell Mine: located approximately one mile due south of Mount Hope, just north of the lake at the head of Copper Run and north of the east-west road near this mine, in the northern half of the south-central rectangle.

Reed Hill Mine: located about two miles west of Maria Furnace and Iron Springs, on the north side of Toms Creek, in the south-central rectangle.

Bingham Mine: located about 1/2 mile northeast of Pine Mountain, just west of the road between Gladhill and Maria Furnace, in the south-central

quadrangle.

Virgin Mine: located approximately 3/4 mile west of Pine Mountain and just west of the Franklin-Adams County Line.

Minerals:

Native copper (occasionally found in crystals); bornite; chalcocite (rare); malachite; azurite (small crystals); cuprite (rarely crystalline); chlorite (variety prochlorite); quartz, hematite; asbestos (variety chrysotile); epidote (generally massive). Most interesting collectable mineral: native copper.

Geology:

The native copper occurs as wires, leaves, and small masses. The minerals all occur in basalt. Because of the presence of much epidote and chlorite in the basalt, the rock is often called a greenstone. This basalt was at one time a lava flow. Gases escaping from the lava flow as it cooled made small cavities, called vesicles, in the basalt which have since been filled in with the copper and other minerals. Fractures in the lava have also been mineralized.

Native copper is a primary mineral, meaning that it formed directly from a solution before the other copper minerals. Most of these other copper minerals formed from the native copper by alteration. These are termed secondary minerals.

Similar Occurrences:

The Keweenawan copper deposits of Michigan.

Selected References:

Bailey, J. T. (1883), The Copper Deposits of Adams County, Pennsylvania, Eng. Min. Jour., vol. 35, p. 88.

Bevier, G. M. (1914), The Present Status of the Copper

Development in the South Mountain Region, Pa. Geol. Survey, 3rd ser., Biennial Rept., Appendix C.

Stose, G. W. (1910), The Copper Deposits of South Mtn. in Southern Pennsylvania, U. S. Geol. Survey, Bull. 430, p. 54.

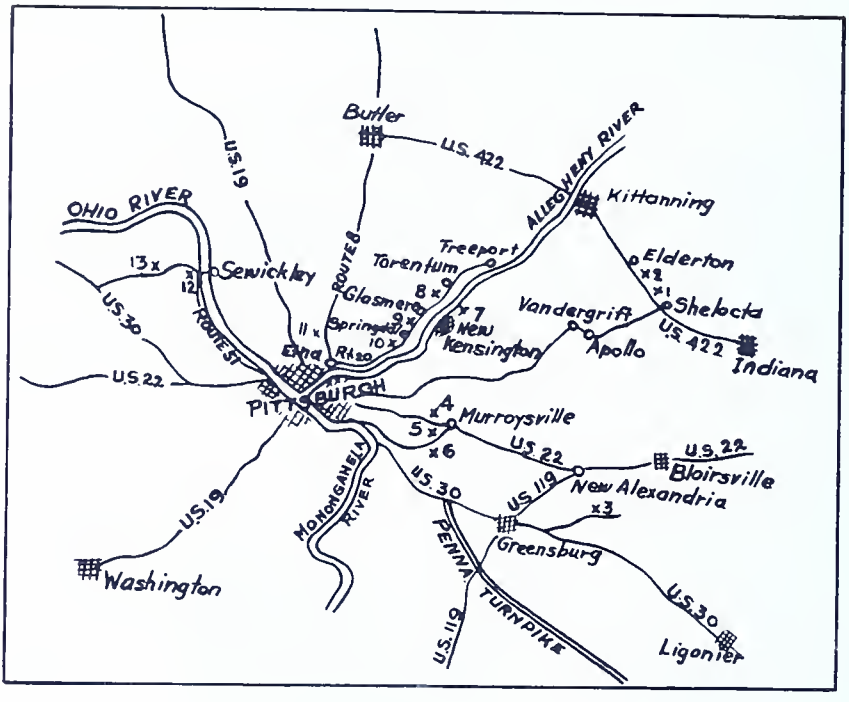
_____ and Bascom F. (1929), Fairfield- Gettysburg Folio #225, U. S. Geol. Survey.

Wherry, Edgar T. (1911), The Copper Deposits of Franklin-Adams Counties, Pennsylvania, Jour. Franklin Inst., pp.151-163.

ALLEGHENY COUNTY

Wurtzite Mineral Localities

Location:



There are several localities for wurtzite in Allegheny County, as well as in Indiana, Armstrong and Westmoreland Counties. Several of the most productive are listed here. Others are numbered on the accompanying map taken from David Seaman's and Howard Hamilton's article (1950) listed below. The locality numbers correspond to those used by Seaman and Hamilton.

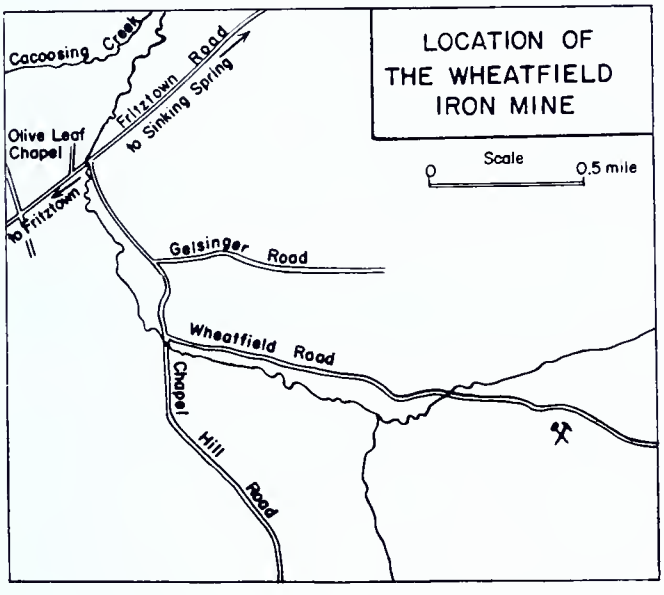
3. In a railroad cut along the main line of the Pennsylvania Railroad just east of the station at Donohoe, approximately four miles east of Greensburg, Westmoreland County; the Latrobe quadrangle, southwest rectangle. About one in four concretions contain wurtzite crystals.
7. At the old brickyard quarry at Valley Camp, Westmoreland County; the New Kensington East 7-1/2 minute quadrangle, northwest rectangle.
9. At the Glassmere Brick Co. quarry at Glassmere,

BERKS COUNTY

Wheatfield Mine: Magnetite Mineral Locality

Location:

The Wheatfield iron mine is located in the east-central rectangle of the Sinking Spring 7-1/2 minute quadrangle. Traveling south, take the Fritztown Road from Sinking Spring for two miles, turn left on Chapel Road, proceed for 1/2 mile, turn left again on Wheatfield Road and proceed on this road for one mile. The mine is an open pit next to the town dump along the south side of the road, in Spring Township at latitude 40° 17' 42" and longitude 76° 01' 41".



Minerals:

Magnetite; hematite; pyrite (small crystals); chlorite (crystallized); chlorite-vermiculite (crystallized); calcite; serpentine; garnet (grossularite, melanite and andradite probable varieties); amber fluorite (rare); stilbite (rare).

Geology:

The iron deposits, and the other associated minerals, occur in limestone. This limestone lies underneath Triassic diabase, and has been altered (metamorphosed) into a marble by heat emanating from the diabase as it cooled. In addition, hot solutions either from the cooling diabase itself, or traveling upward along the base of the diabase

reacted with the limestone, dissolved some of it, and replaced the limestone with serpentine, garnets, chlorite, and iron minerals. Chlorite, vermiculite, and the iron minerals are found close to the contact of the diabase and limestone. Melanite garnets are found along fractures within the basal poritons of the diabase, while the other garnet varieties are in the limestone, some at quite a distance from the diabase.

Similar Occurrences:

Cornwall and French Creek, Pennsylvania.

Selected References:

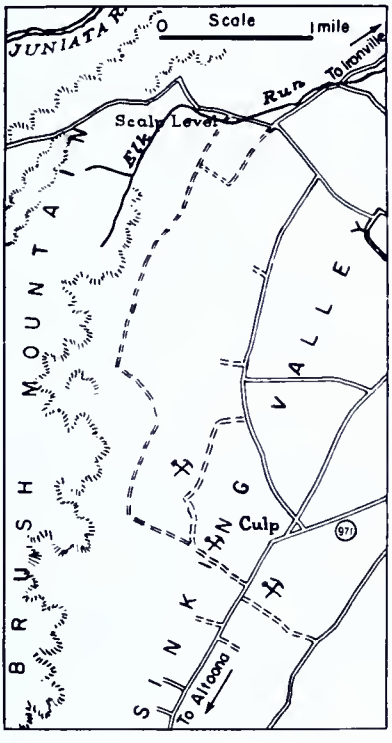
Spencer, Arthur C. (1908), Magnetite Deposits of the Cornwall Type, U. S. Geol. Survey, Bull. 359,pp. 29-36.

BLAIR COUNTY

Sinking Valley: Lead-Zinc Mineral Locality

Location:

The lead-zinc mineral localities in Sinking Valley, Blair County, are located in the east central and southeast rectangles of the Altoona quadrangle. The majority of the occurrences are northeast of Altoona, in the vicinity of the village of Culp in Tyrone Township. Small individual mines and pits are located -



1) on the southeast and northeast sides of Route 971 at Culp,
2) on the west side of the Culp-Scalp Level road about 1/4 mile north of Culp, and
3) on the northwest and southeast sides of the Scalp Level - Ironville road about 1/2 mile southwest of the junction of this road with Route 220, and
4) outcrops and float may be found in the fields along Elk Run.

Minerals:

Galena (massive cleavages); anglesite (crystals and massive); cerussite (crystals and massive); sphalerite (massive and cleavages); smithsonite (massive and banded); hemimorphite (massive and small crystals); barite (massive); dolomite (massive and cleavage rhombs); calcite (massive and cleavage rhombs); pyrite (massive and small crystals); limonite.

Geology:

All of the above minerals are found associated with limestone. In some cases, the minerals fill fractures within the limestone; in other instances, the limestone has been dissolved by mineral-rich solutions and these new minerals

have taken the place of the limestone. The anglesite, cerussite, smithsonite, and hemimorphite all formed by weathering of the galena, sphalerite, and dolomite. These minerals, formed by weathering, are closely associated with limonite and are called gossan minerals. The localization of the minerals was determined by the ease with which the limestone could be dissolved, and by the number of fractures in the limestone. The fractures, in turn, are controlled by the upward bending of the rocks into a fold, called the Sinking Valley Anticline.

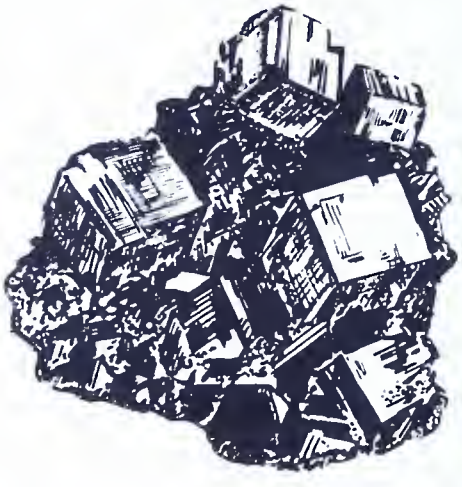
Similar Occurrences:

Friedensville lead-zinc in Saucon Valley; Mississippi Valley.

Selected References:

Butts, Charles, Swartz, F. M. and Willard, Bradford (1939), Tyrone Quadrangle, Pa. Geol. Survey, Atlas 96, pp. 90-92.

Reed, Donald F. (1949), Investigation of the Albright Farm Lead-Zinc Deposit, Blair County, Pennsylvania, U. S. Bur. Mines, R. I. 4422, pp. 1-7.

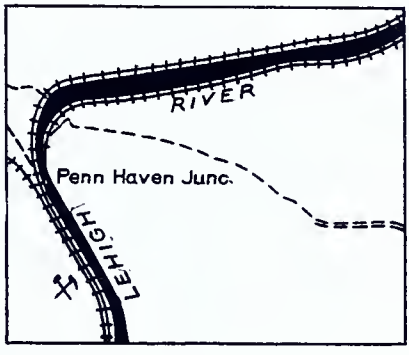


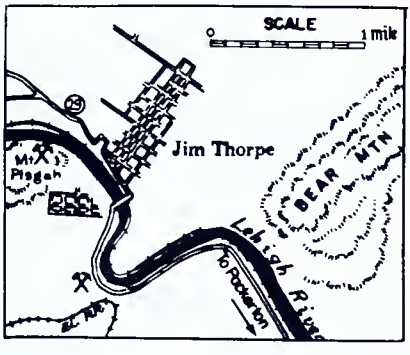
CARBON COUNTY

Mauch Chunk: Uranium Mineral Locality

Location:

The uranium mineral collecting localities are located in the west-central rectangle of the Mauch Chunk quadrangle. Two areas within this rectangle are most promising; they are 1) at Mt. Pisgah approximately 1/2 mile west of Jim Thorpe, and 2) at Mauch Chunk Ridge about 1/2 mile south of Jim Thorpe where there is a tunnel opening on the south side of Routes 209 and 29. In the northwest rectangle of the same quadrangle, about 1/2 mile southeast of Penn Haven Junction, there is another occurrence similar to the ones near Jim Thorpe.





Minerals:

Mt. Pisgah: carnotite, tyuyamunite, uraninite(?) schroeckingerite, liebigite, andersonite, uranophane, beta-uranophane, kasolite (?), gypsum, opal (?), allophane (?).

Mauch Chunk Ridge: carnotite, meta-autunite, meta-torbernite, meta-uranocircite (?).

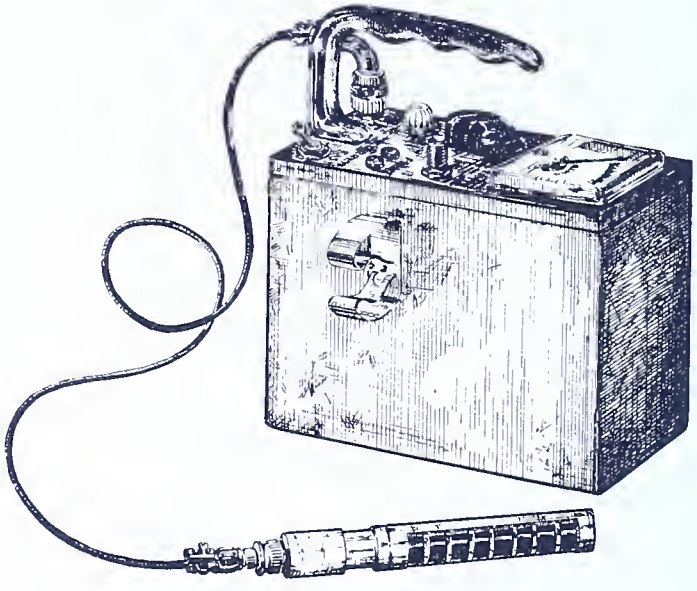
Penn Haven Junction: carnotite, clausthalite, uraninite (?).

Note: Uranium minerals other than carnotite are difficult to obtain.

CARBON COUNTY

Geology:

All of the occurrences listed above have a similar geologic environment and a similar geologic history. They are located on the northern edge of the eastern end of the Appalachian Mts. in Pennsylvania. The sedimentary rocks here have been bent (folded) into troughs and ridges. To the north lies the Pocono Plateau where the beds of sedimentary rocks are nearly horizontal. The uranium and associated minerals are in folded red sandstones or conglomerates of Devonian (Mauch Chunk Ridge; Penn Haven Junction) and Pennsylvanian (Mt. Pisgah) age. Within these sedimentary rocks, there are lenses of sandstone which contain carbonaceous material. It is in these lenses that the uranium minerals are found. Similar lenses and channels contain the uranium ores of the Colorado Plateau in the Western United States. Since the Colorado Plateau uranium is thought to be localized in old, buried stream channels, the same origin is inferred for these Carbon County occurrences.



Similar Occurrences:

In Bradford, Sullivan, Lycoming, Columbia, and Wyoming Counties in the Catskill Formation; the Colorado Plateau.

CARBON COUNTY

Selected References:

Dyson, James L. (1955), Relation of Stratigraphy and Structure to Uranium Occurrences near Mauch Chunk, Pennsylvania, Pa. Geol. Survey, I. C. 5, pp. 124-134.

McCauley, John F. (1957), Preliminary Report on the Sedimentary Uranium Occurrences in Pennsylvania, Pa. Geol. Survey, P.R. 152, pp. 1-22.

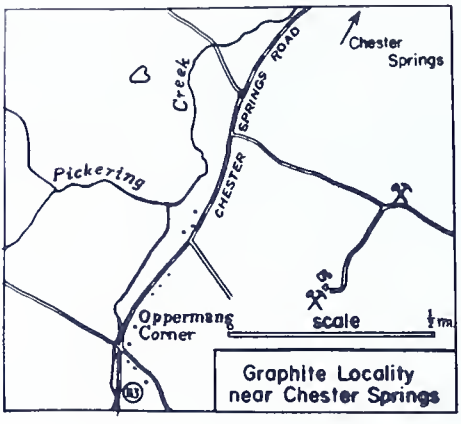
Montgomery, Arthur (1954), Uranium Minerals of the Mauch Chunk Area, Pennsylvania, Pa. Acad. Sci., vol. 28, pp. 102-110.

CHESTER COUNTY

Ben Franklin Mine: Graphite Mineral Locality

Location:

The graphite quarries of the Graphite Corporation of America are located 1/2 mile northeast of Opperman's Corners on Route 113 in West Pikeland Township; in the northeast corner of the east-central rectangle of the Downingtown 7-1/2 minute quadrangle; at latitude 40° 04' 50" and longitude 75° 37' 30".



The plant and quarries are active and permission must be obtained.

Minerals:

Graphite (foliated massive and flake); quartz (white and blue massive); feldspar; pyrite; biotite; hornblende; limonite; garnet.

Geology:

The graphite occurs in several different geological associations. The majority is present as foliae and flakes in a rather compact quartz-mica schist. This schist is a metamorphic rock, which means that heat and pressure have been applied to a sedimentary rock, such as a shale. The application of this heat and pressure has resulted in the alignment of mineral grains along parallel planes. This parallel arrangement is called schistosity. Graphite

is one of the minerals which is aligned along these schistosity planes. Graphite is also abundant in quartz veins, and may result in concentrations of a high grade. Two less important modes of occurrence are as graphite flakes along cleavage planes of feldspar and along schistosity planes in a biotite-hornblende-feldspar rock. The graphite concentration owes its origin, at least in part, to the metamorphism which altered some previous sedimentary rock.

Selected References:

Miller, B. L. (1912), Graphite Deposits of Pennsylvania, Pa. Geol. Survey, 3rd ser., Econ. Rept., pp. 67-82, 96-110.

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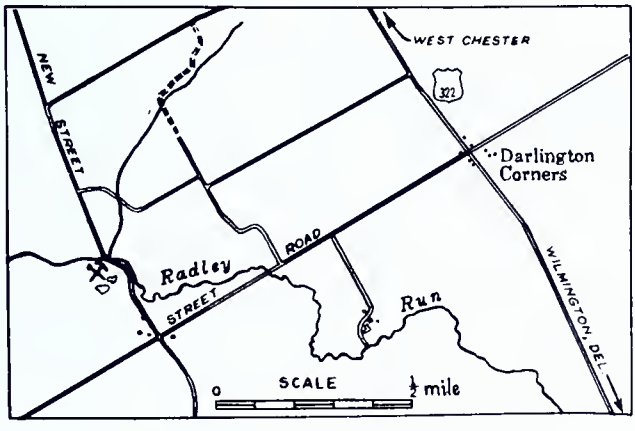
Brinton Quarry: Vermiculite Mineral Locality

Location:

The Brinton quarry is located in the northern half of the southwest rectangle of the West Chester 7-1/2 minute quadrangle, at latitude 39° 54' 53" and longitude 75° 35' 42", 1.4 miles south of the southwest corner of the Boro Boundary line.



This locality is a private swimming pool, and permission to enter must be obtained from the Quarry Swimming Club or from the nearby Crebilly Farm.

CHESTER COUNTY

Minerals:

Vermiculite (brown crystal prisms); chlorite (green crystal prisms); chlorite-vermiculite; actinolite; talc; tourmaline (rare); feldspar (massive oligoclase cleavages); beryl (rare); quartz (massive); amphibole asbestos; serpentine; aragonite; deweylite; magnesite; calcite rosettes (rare); bronzite (uncommon); small hematite crystals; magnetite (grains in serpentine, nodules in soil); chromite (uncommon).

Geology:

Based on their geologic occurrence, the above minerals may be divided into two groups. The first group contains minerals irregularly distributed throughout the serpentine. These include the various serpentine minerals, bronzite, chromite, and magnetite. The majority of collectable minerals belongs in the second group: minerals which are concentrated along fractures in the serpentine. In this latter group there are two general kinds of fracture fillings. The most common fillings contain actinolite on the borders with chlorite and vermiculite crystals in the center, and rarely feldspar. The other type of fracture filling is coarsely crystalline (pegmatitic) quartz and feldspar dikes which contain small amounts of tourmaline and beryl. The borders of these dikes also have chlorite and vermiculite. These latter two minerals are the result of a chemical reaction between the silica-rich, heated solutions which formed the quartz-feldspar dikes, and the minerals already present in the serpentine.

Similar Occurrences:

The Line Pit and Low's Pit (see "Lancaster County, Chromite Locality") Pennsylvania; Greenville, South Carolina; Libby, Montana.

Selected References:

Gordon, Samuel G. (1922), The Mineralogy of Pennsylvania, Phila. Acad. Nat. Sci., Spec. Pub., no. 1,

pp. 182-183.

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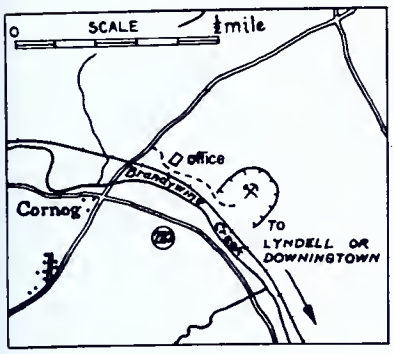
Cornog: Blue Quartz Mineral Locality

Location:

The quarry at Cornog is located in the west-central rectangle of the Downingtown 7-1/2 minute quadrangle. The quarry may be reached by traveling north from Downingtown on Route 282, through the village of Lyndell, and turning right at the cross-roads in Cornog. The quarry is in operation and permission to enter must be obtained at the office. The exact location is at latitude 40° 04' 38" and longitude 75° 44' 56".



Minerals:

Blue quartz (massive); garnet; calcite, chlorite; hornblende; feldspar; pyrrhotite (massive); pyrite; chalcopyrite (massive); galena (rare); zoisite; allanite (?); titanite; epidote. Most interesting minerals; blue quartz, pyrrhotite.

Geology:

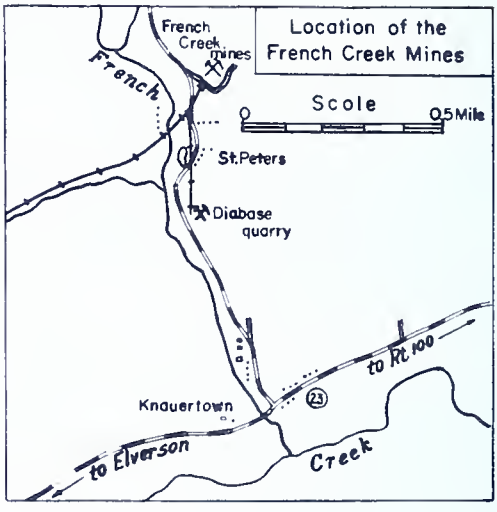
The blue quartz occurs as lenses and stringers in a banded hornblende-quartz-garnet rock. The rock is a hornblende gneiss, which is a metamorphic rock formed by heat and pressure applied to a previous sedimentary rock. A gneiss such as this has a banding, or layered texture, which is similar to that of a schist, except that the banding is generally one of alternating light and dark colored minerals, and is more compact than in a schist. The origin of the quartz is, at least in part, a result of the heat and pressure applied during metamorphism. The blue color in the quartz is caused by small needle-shaped inclusions within the quartz.

CHESTER COUNTY

French Creek: Magnetite Mineral Locality

Location:

The French Creek mines are located just west of French Creek in Warwick Township approximately 3/4 mile north of Knauertown and 1/8 mile north of the village of Saint Peters; in the west-central rectangle of the Pottstown 7-1/2 minute quadrangle; latitude 40° 11' 02" and longitude 75° 43' 48".



Collecting is best on the large mine dumps adjacent to the abandoned railroad tracks.

Minerals:

Common: Magnetite (platy, octahedral crystals, massive); hematite; chalcopyrite (crystals); pyrite (crystals); green calcite (crystals); covellite and bornite (coatings); malachite (coatings); azurite (coatings); chlorite; actinolite (fibrous byssolite); hornblende; calcite; feldspar; garnet (andradite and grossularite crystals); epidote (massive); biotite; graphite; quartz; aragonite; anthophyllite; talc.

Rare: Apophyllite (crystals); stilbite (crystals); heulandite (crystals); epidote (crystals); apatite; zoisite; augite; pyrrhotite; wernerite; chalcodite; tourmaline; ankerite; rhodochrosite; sphalerite; chrysocolla; gypsum.

Most interesting minerals: platy magnetite and magnetite octahedra, byssolite, heulandite, grossularite, chalcopyrite tetrahedra; green calcite with byssolite inclusions.

CHESTER COUNTY

Geology:

The magnetite and associated minerals occur in limestone. They have replaced the limestone by dissolving it, and crystallizing other minerals in its place. The ore and sulfide minerals are found both as massive lenses or pods and scattered throughout the limestone. The other minerals which are not potential ores are termed gangue (or accessory) minerals. These are generally on the fringes of the massive ore and continue for quite a distance away from the ore, into the limestone. This mineralization of the limestone occurred next to an intrusive igneous rock, diabase, which has cut through the limestone. For this reason, the origin of the ore and other minerals is believed to be related to the diabase.

Similar Occurrences:

Warwick, Hopewell, and Jones Mines in this vicinity; also Cornwall, Morgantown, and Wheatfield iron mines.

Selected References:

Smith, Laurence L. (1931), Magnetite Deposits of French Creek, Pennsylvania, Pa. Geol. Survey, 4th ser., Bull. M 14, pp. 1-52.

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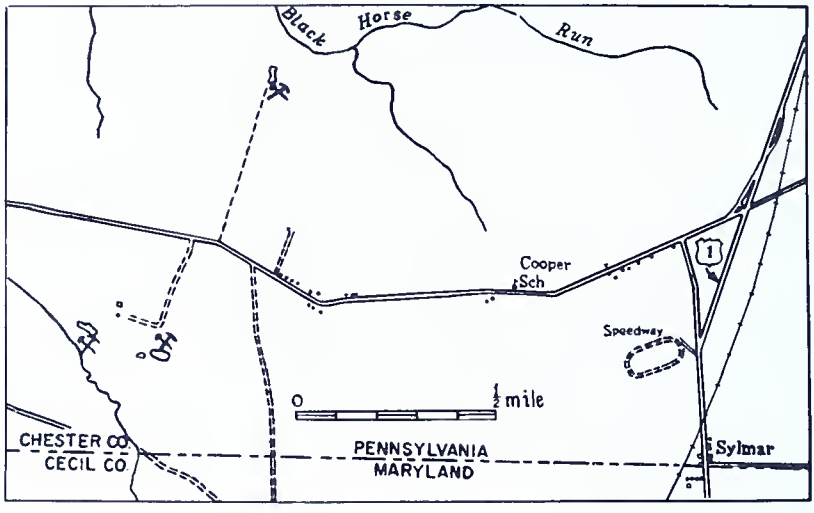
Sparvetta Quarries: Feldspar Mineral Locality

Location:

The Sparvetta quarries are located in the north-central rectangle of the Rising Sun 7-1/2 minute quadrangle, approximately 1 1/4 miles southwest of Nottingham in West Nottingham Township.

The quarries are now abandoned and filled with water.

They appear as small lakes on the map illustration. Collecting is excellent from the large mine dumps adjacent to these quarries.



Minerals:

Feldspar (albite and rare moonstone); chlorite; quartz, serpentine; goethite (reniform); tourmaline (very rare); actinolite; amphibole asbestos; zoisite (rare); apatite; muscovite; molybdenite (very rare); colerainite (very rare, on feldspar); chlorite-vermiculite. Interesting minerals: feldspar, colerainite; large goethite masses in nearby fields, behind Cooper School.

Geology:

The majority of the above minerals occur in a coarse textured quartz and feldspar rock which is called a pegmatite. In general, the coarser the grain size of this pegmatite, the larger are the crystals of the accessory minerals, such as tourmaline and muscovite. The distribution of minerals other than quartz and feldspar, - the accessory minerals as these minor constituents are called, is often quite irregular. The pegmatite which contains these minerals formed by cooling and crystallization from hot solutions. These solutions flowed through

fractures in a dark serpentine rock which is the major rock type in this area.

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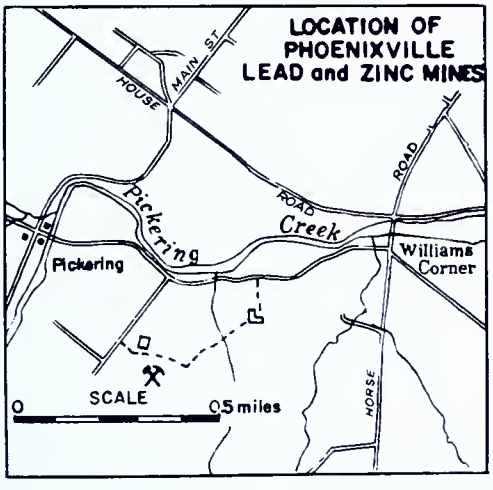
Wheatley and Chester Mines, Phoenixville: Lead-Zinc Mineral Locality

Location:



The Wheatley and Chester mines are located in the northeast rectangle of the Malvern 7-1/2 minute quadrangle. The mines are located about 0.2 miles south of the road between the villages of Pickering and Williams Corner. The mines and dumps may be reached by turning right at the first dirt road east of the village of Pickering, and proceeding south about 0.15 miles to a small white building on the left. This building and property belongs to a private hunting and shooting club. Permission to enter must be obtained from the club because of safety reasons. Proceed along a path south of the hunting club building about 300 feet, and then walk south, uphill, to the dumps.

Minerals:

Common: Galena (massive); sphalerite (massive); pyromorphite (crystals); barite (massive); anglesite (occasional crystals); quartz (milky crystals); chlorite; hemimorphite (crystals); calcite; pyrite; chalcopyrite; aragonite (tufted crystals); dolomite (cleavage rhombs); enstatite; malachite (coatings); micaceous hematite; bornite; goethite. Most interesting mineral:

pyromorphite; wulfenite (small crystals); cerussite (massive).

Rare: Cerussite (crystals); ankerite; fluorite (crystals); mimetite -vanadinite (crystals); gersdorffite (crystals); sulfur (minute crystals); native copper; cuprite; chalcocite; azurite (crystals); erythrite; silver.

Geology:

The lead, zinc, and associated minerals occur in granitic rock which is rich in microcline and orthoclase feldspar. This rock is called monzonite. Its major difference from true granite is that it contains less quartz, and hence is slightly more basic than granite. This monzonite is an intrusive, igneous rock. The ore minerals crystallized later than the monzonite, being localized along fractures, and, in places, actually replaced the monzonite. Later weathering has altered some of the ore minerals, such as galena, to secondary minerals, such as cerussite, anglesite, and pyromorphite. The two abandoned mines south of Phoenixville mentioned here are only two of several which were once operated in this area. This is an area of widespread lead-zinc mineralization, which implies that all of these minerals formed at about the same time and came from hot solutions which had the same source at depth.

Selected References:

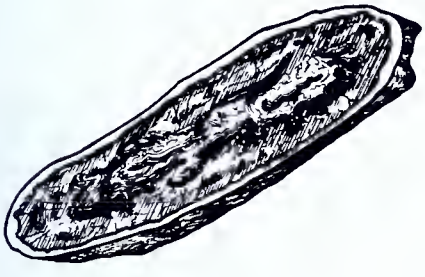
Miller, B. L. (1924), Lead and Zinc Ores of Pennsylvania, Pa. Geol. Survey, 4th ser., Bull. M 5, pp. 31-43.

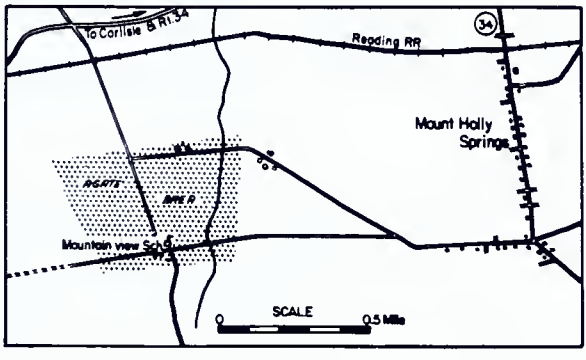
CUMBERLAND COUNTY

Mt. Holly Springs: Agate Mineral Locality

Location:

The agate locality near Mt. Holly Springs is located 1.2 miles west of the town and Route 34. If traveling south, turn left (west) at the brownstone bank building on the corner; proceed 0.4 mile to where the road forks, bear right; at 1.2 miles west of Route 34 there is a farmhouse on the north side of the road and the entire field south of the farmhouse contains chalcedony and agate concretions. Some collecting may be found along fence rows where farmers have piled loose stones. The collecting area is located in the north-central rectangle of the Mt. Holly Springs 7-1/2 minute quadrangle.





Minerals:

Agate and chalcedony (light and dark gray banded). The concretionary shapes vary from irregular to spherical. Banding is generally present.

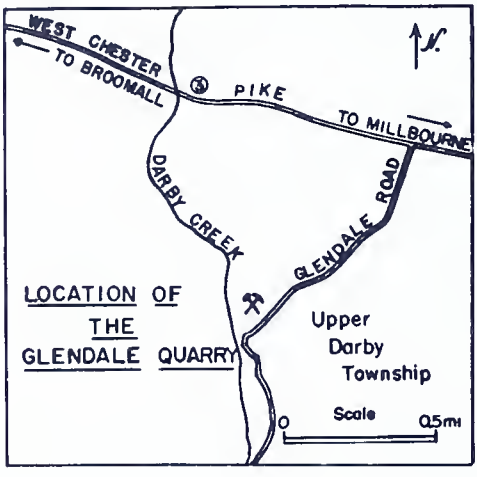
Geology:

The agate and chalcedony are found loose in the soil. They are derived by weathering from the dolomite rock which lies below this soil. The dolomite is a sedimentary rock having an overall composition very similar to the mineral, dolomite.

DELAWARE COUNTY

Glendale Quarry: Beryl Mineral Locality

Location:



The Glendale quarry is located in the southwest corner of the north-central rectangle of the Lansdowne 7-1/2 minute quadrangle. The entrance to the quarry is on Glendale Road just north of the point where Glendale Road parallels Darby Creek. This quarry (latitude 40° 57' 56" and longitude 75° 20') is in Upper Darby Township about a mile south of the intersection of the West Chester Pike (Route 3) and Darby Creek.

Minerals:

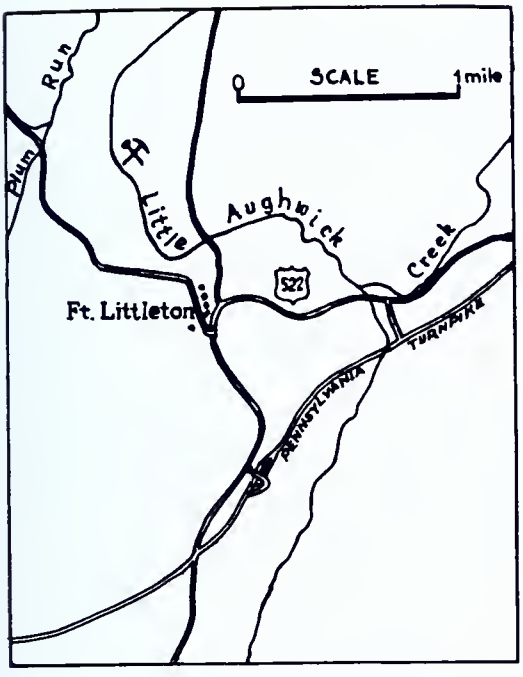
Beryl (crystals up to three inches in length); quartz (massive); feldspar (massive); muscovite (small books and flakes); tourmaline (? - reported).

Geology:

The beryl and associated minerals are found rather irregularly distributed through a coarse grained quartz and feldspar rock. Because of this coarse texture, it is called a pegmatite. The unusual minerals found in pegmatites, such as at the Glendale quarry, are evidence that hot solutions entered the crust of the Earth from some source at greater depth, bringing in with them rarer elements like beryllium and boron. These hot solutions invaded the surrounding rock, - a gneiss, cooled, and crystallized as a pegmatite.

FULTON COUNTY

Fort Littleton: Barite Mineral Locality



Location:

This locality is located in the west-central rectangle of the Orbisonia quadrangle, about one mile northwest of Fort Littleton and 1-1/2 miles northwest of the Fort Littleton interchange on the Pennsylvania Turnpike. An open pit and dumps are located in a farm pasture beyond the cemetery.

Minerals:

Barite (massive); calcite; chalcopyrite; pyrite; quartz (massive).

Geology:

The barite is found in limestone along a fracture in the rock. This fracture is one on which there has been rock movement, and is called a fault. The movement of the limestone on either side of this fault has crushed pieces of limestone into different sized pieces, generally in angular shapes, and into a finely crushed limestone. The barite has replaced this fragmented limestone, called a fault breccia, and has also filled in some open fractures. The barite is believed to have been deposited from hot, rising solutions which carried the barium upward along the fault.

Selected References:

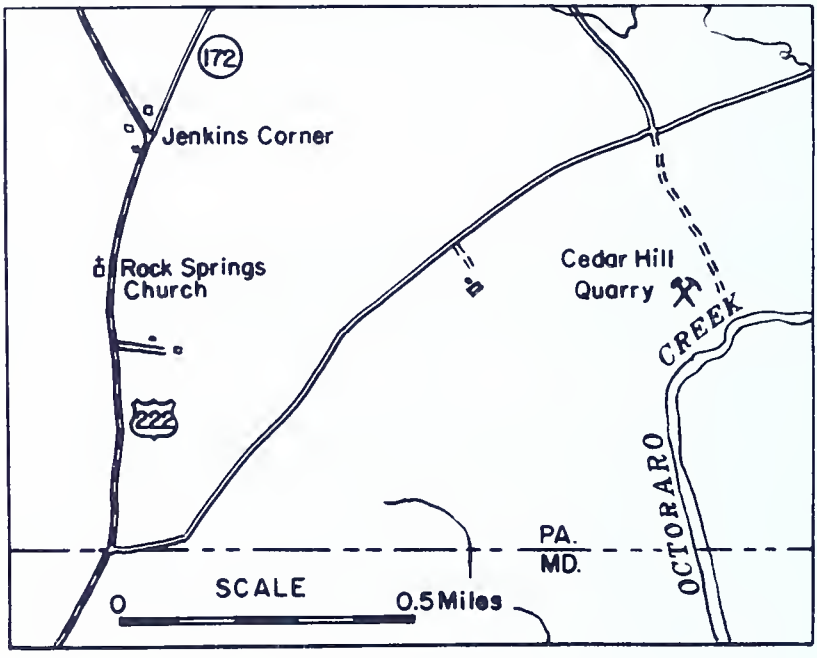
Socolow, Arthur A. (1959), Geology of a Barite Occurrence, Fulton County, Pennsylvania, Proc. Pa. Acad. Sci., vol. 33.

LANCASTER COUNTY

Cedar Hill Quarry: Serpentine Mineral Locality

Location:

The Cedar Hill Quarry is located in the northeast rectangle of the Conowingo Dam 7-1/2 minute quadrangle, just north of the Pennsylvania-Maryland state line. The quarry (latitude 39° 43' 40" and longitude 76° 08' 12") may be reached by going east one mile from Pa. Route 222-72 at the Pennsylvania-Maryland state line. Road signs for the quarry mark the way. There is good collecting on the dumps near the quarry entrance, but the best specimens may be obtained from the quarry itself. Permission must be obtained since the quarry is in operation. The quarry office is located beyond the crushers, opposite the working face of the quarry.



Minerals:

Williamsite (translucent green); antigorite (massive serpentine and hard fiber); magnetite (disseminated grains); chromite (disseminated grains; rarely in veins south of the quarry along the Octoraro Creek); pyrite (grains); magnesite; brucite (crystal plates along fractures in the center of the quarry working face); deweylite (white crystals; and brown and white fluorescent); hydromagnesite;

vermiculite (brown crystals in altered chlorite dike); chlorite (variety clinochlore, crystals); talc; genthite (coatings); feldspar (pegmatitic fracture fillings); chalcedony (banded and mammillary, - both uncommon); calcite (small rhombs); aragonite (uncommon); limonite; crocidolite (fibrous coatings on fracture surfaces). Most interesting mineral: brucite crystals, which are abundant; fluorescent deweylite of which the green variety is nickel-bearing; small radiating groups of deweylite crystals (rare) on magnesite, dolomite, and brucite.

Geology:

The geologic association of the minerals found here are of two types. The chromite, magnetite, serpentine minerals, and pyrite are found within massive serpentine. All the other minerals are found along fractures or as dikes in the serpentine. Most of them represent an alteration of the earlier-formed serpentine minerals, either by hydrothermal (heated solutions) alteration or as the result of weathering and groundwater action. The original rock, before becoming serpentine, was a dunite (olivine rock) with minor amounts of pyroxene, chromite, and magnetite. Many fractures and faults are visible in the quarry.

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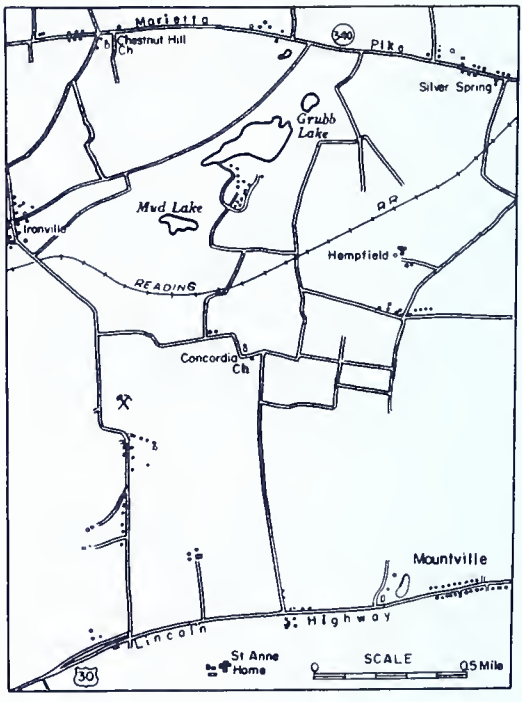
Chestnut Hill: Limonite Pseudomorph Mineral Locality

Location:

The limonite pseudomorph locality is located in the central rectangle of the Columbia East 7-1/2 minute quadrangle, one mile north of the intersection Route 30 (Lincoln Highway) and the St. Josephs Academy road. The pseudomorphs may be found in the fields and gullies at this locality. There is room to park several cars on the s-curve in the road near the locality. Grubb Lake and Mud Lake, about one mile to the northeast of the pseudo-

morph locality are good collecting localities for massive limonite and limonite geodes ("bombs").



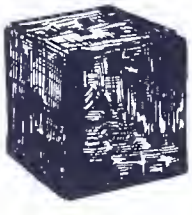
Minerals:

Chestnut Hill: unusually fine limonite pseudomorphs after pyrite.

Mud and Grubb Lake: limonite concretions, kaolinite clay, goethite concretions.

Geology:

The limonite cubes found in the fields along Chestnut Hill have weathered out of the rock lying underneath the soil cover. This rock contains a large amount of mica, with some quartz and feldspar. It is a metamorphic rock, and, because of its layered and platy character, is called a phyllite. The orientation of the mica plates into layers is the result of the heat and pressure applied to the rocks at the time they were folded. The limonite cubes have been altered from pyrite cubes. Some of these limonite cubes, called pseudomorphs after pyrite, still retain some of the original pyrite inside. This change from pyrite to limonite is probably the result of weathering, which attacked the pyrite and removed its sulfur content while, at the same time, retaining the original pyrite shape. Occasionally even the striations from the pyrite cube faces may still be seen on the limonite



pseudomorph ("false form") faces.

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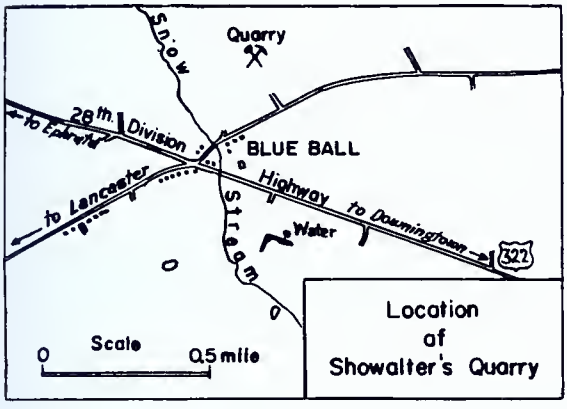
Showalter Quarry: Calcite Mineral Locality

Location:



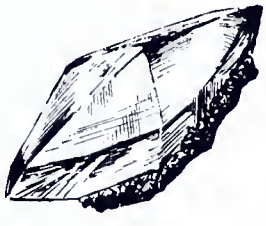
The Showalter Quarry at Blue Ball is located in the northeast rectangle of the New Holland 7-1/2 minute quadrangle. The quarry is about 1/8 mile north of the town and is in operation. Permission must be obtained at the quarry office before entering.

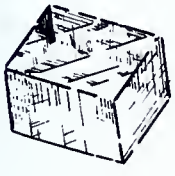
Minerals:

Calcite (dog-tooth crystals, pink and white); quartz; feldspar (massive, pink); pyrite (distorted cubes); chalcopyrite (small crystal tetrahedra); hematite (specular); chlorite; clay minerals; rutile (uncommon); fluorite (uncommon). Most interesting minerals: vugs containing chalcopyrite crystals on calcite crystals.

Geology:

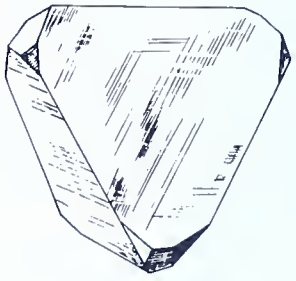
All of the above minerals occur in limestone, either scattered throughout the limestone, or as fillings of fractures and open cavities. The scattered type occurred by the dissolving away of limestone and the deposition of other minerals in place of the limestone. This is called replacement. Pyrite is the most common mineral formed in this way.





The fracture and cavity fillings resulted in a greater variety of minerals and in larger crystals. The calcite crystals probably formed by solution of the limestone and then

redeposition in open spaces in the rock. The presence of chalcopyrite and fluorite, and the presence of a quartz-feldspar pegmatite, indicate that these solutions were probably heated and introduced from some depth below the surface.



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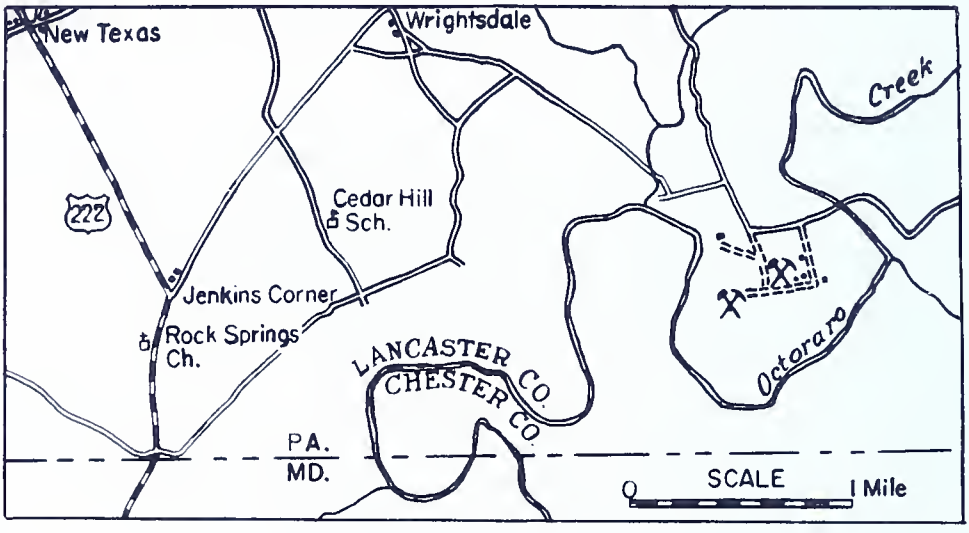
Wood Chrome Mine: Chromite Mineral Locality

Location:

The Wood Mine is located in the northwest rectangle of



the Rising Sun 7-1/2 minute quadrangle; 1/2 mile north of the Pennsylvania-Maryland state line; in a meander of the Octoraro Creek; latitude 39° 43' 54" and longitude 76° 06' 36". The Line Pit and Low's Mine are located in the north-central rectangle of the Conowingo Dam 7-1/2 minute quadrangle; almost directly on the Pennsylvania-Maryland state line and one mile northwest of Rock Springs, Maryland. At both localities there is a deep pit and numerous mine dumps.

LANCASTER COUNTY

Minerals:

The same minerals have been found at both localities with the exceptions noted below.

Common minerals: Clinochlore (loc. 1, crystals); chromite; magnesite; hydromagnesite (crusts); antigorite (variety williamsite, loc. 2); chrysotile (variety picrolite); chrome antigorite (fibrous); genthite; brucite (crystals); chlorite - vermiculite (loc. 2); deweylite (loc. 1); aragonite (crystal tufts and needles); calcite; chalcedony; quartz; pyrite; magnetite; talc (loc. 2).

Uncommon to rare: Kammererite (crystals); cacoxenite (loc. 1, radiating needles); zaratite (loc. 1); chalcocite; millerite; uvarovite; vesuvianite (loc. 1). Most interesting minerals: brucite, kammererite, williamsite, chromite, deweylite, chrome antigorite, zaratite.

Geology:

The large variety of minerals at the Wood Mine is the result of a complex geologic history. Each of the different geologic processes crystallized a particular suite of minerals, so that association becomes an important clue to the minerals which one can expect to find. The first event was the intrusion of a dark colored rock rich in olivine, and containing lesser amounts of enstatite, chromite, and magnetite. The second major event was the introduction of hot solutions whose composition was approximately that of serpentine. These solutions also attacked the olivine-enstatite-chromite rock and formed new minerals in addition to the serpentines (antigorite, chrysotile, and williamsite). The new minerals thus formed were recrystallized chromite, magnetite, uvarovite, chrome antigorite, and chrome chlorite (kammererite). Either later in this sequence of crystallization, or separated from it by a short time interval, the composition of the thermal solutions became such that chlorite-vermiculite, clinochlore, and small amounts of pyrite formed. Some magnesite may also have formed along fractures in the rock. By that time, there was no

more chromium available to incorporate in definite minerals, so that these minerals are found in serpentine, but generally not closely associated with chromite. Following this, weathering, ground waters, and relatively low temperature solutions resulted in magnesite, hydromagnesite, calcite, chalcedony, aragonite, deweylite, cacoxenite, genthite, brucite, and zaratite along fractures and in vugs within the serpentine rock.

Similar Occurrences:

Many smaller chromite pits in the area, such as the Red Pit, Wet Pit, Geiger Pit, etc.; further to the east: Kirk, Rhodewalt, Hilaman, and Pine Grove (Pearre and Heyl, 1959); also the chromite deposits of California (Siskiyou County etc.).

Selected References:

Duersmith, L. J. (1951), Wood's Chrome Mine, Lancaster County, Pennsylvania, Rocks and Minerals, vol. 26, no. 5-6, pp. 243-247.

Lapham, Davis M. (1958), Preliminary Report on the Chromite Occurrence at the Wood Mine, Pennsylvania, Pa. Geol. Survey, 4th ser., P.R. 153.

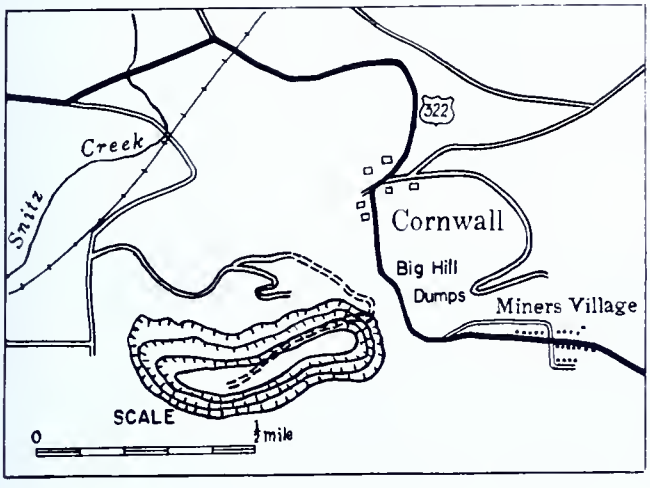
Pearre, Nancy and Heyl, Allen (1959), The History of Chromite Mining in Pennsylvania and Maryland, Pa. Geol. Survey, 4th ser., I. C. 14.

LEBANON COUNTY

Cornwall Mine: Magnetite Mineral Locality

Location:

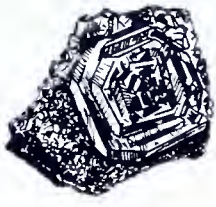
The Cornwall mine is located in the south-central rectangle of the Lebanon 7-1/2 minute quadrangle; along Route 322 between the village of Cornwall and Miners Village. The open pit is now closed but an excellent view of it may be seen from the observation landing along Route 322. Good collecting is still possible on the Big Hill dumps and at the base of Big Hill along Route 322.



There is a large active program of underground mining currently in operation and permission must be obtained to collect on Big Hill.

Minerals:

Common: Magnetite (octahedra, dodecahedra, plates, massive); chalcopyrite (tetrahedra, massive); pyrite (cubes, pyritohedra); garnets (andradite); chlorite (rarely crystal prisms); tremolite; actinolite (byssolite); phlogopite; hornblende, diopside; augite; serpentine; prehnite; heulandite; quartz; orthoclase; chrysocolla; malachite.



Uncommon: Hematite; native copper; azurite; chalcocite; covellite; cuprite; brochantite; bieberite; erythrite; analcite; apophyllite; thomsonite; natrolite; vesuvianite; sphalerite; fluorite; aragonite; gypsum; rhodochrosite; garnet (grossularite); gmelinite (?); harmotome (?).

LEBANON COUNTY

Most interesting minerals: magnetite crystals; zeolite crystals; garnets.

Geology:

The minerals found at Cornwall are associated with two major rock types: diabase and limestone. Diabase is an igneous rock of dark green color containing feldspars and pyroxenes, with minor amounts of biotite and hornblende. The diabase formed by the crystallization of these minerals from a hot solution which cut upward through the surrounding limestone. This diabase as it cooled and solidified, recrystallized some of the limestone into marble. Several minerals, such as diopside, actinolite, vesuvianite, and garnet, also formed in the limestone partly as a result of the heat and partly as a result of the addition of some chemical elements from the diabase solutions. Later, additional solutions spread outward from the top of the diabase into the limestone. The magnetite, hematite, pyrite, chalcopyrite, chalcocite, covellite, and chlorite formed at this stage. Sometimes they replaced the limestone, and sometimes they replaced the previously formed diopside and actinolite. The zeolites, sulfates, and copper carbonates crystallized last, filling in open fractures and cavities. The consequence of this series of geologic events has resulted in certain minerals being found together. Three such examples are the associations 1) magnetite-chalcopyrite-actinolite, 2) zeolites-chlorite-magnetite, and 3) garnet-tremolite-calcite-serpentine.

Similar Occurrences:

Morgantown, French Creek, Warwick; Wheatfield.

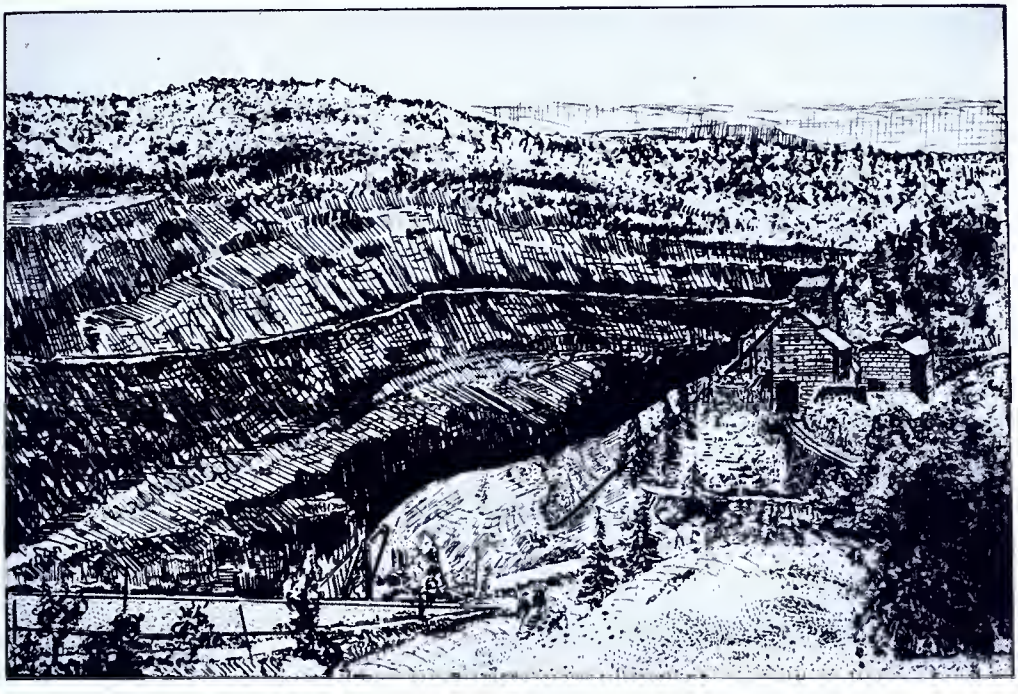
Selected References:

Gray, Carlyle (1956), Diabase at Cornwall, Pennsylvania, Proc. Pa. Acad. of Sci., vol. 30, pp. 182-185.

LEBANON COUNTY

Hickok, William O. (1933), The Iron Ore Deposits at Cornwall, Pennsylvania, Ec. Geol., vol. 28, pp.193-255.

Spencer, A. C. (1908), Magnetite Deposits of the Cornwall Type in Pennsylvania, U. S. Geol. Survey, Bull. 359.

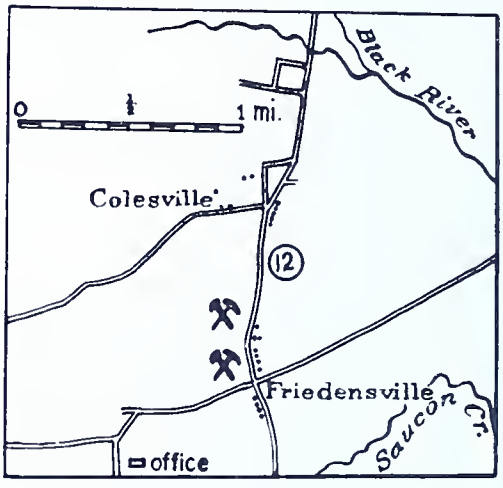


LEHIGH COUNTY

Friedensville Mine: Lead-Zinc Mineral Locality

Location:

The Friedensville mine is located along Route 12, four miles south of Bethlehem at the town of Friedensville, in the south-central rectangle of the Allentown quadrangle. The mine is currently owned and operated by the New Jersey Zinc Company. Permission to collect on the dumps must be obtained at the office located about 1/2 mile west of the cross-roads in Friedensville.



Minerals:

Galena; sphalerite (yellow to black, very fine grained); pyrite; hemimorphite (needles and massive); smithsonite; greenockite (coating); dolomite; quartz; calcite; limonite; hydrozincite; goslarite. Most interesting minerals: sphalerite, hemimorphite, greenockite.

Geology:

The lead-zinc ores and other associated minerals occur in limestone. Some of the mineralized limestone contains angular fragments of dolomite or limestone, and this rock is called a breccia. Both the limestone and the limestone breccia have been partly dissolved and then replaced by galena, sphalerite, pyrite, and quartz. This replacement is often along the bedding planes of the limestone, thus yielding a parallel banding for much of the ore. All of the mineralized limestone sediments have been bent upward into a fold, called the Friedensville anticline, so that the lead-zinc mineralization is not horizontal, but dips in the same direction as the folded beds. Later,

alteration of the galena and sphalerite has produced secondary lead and zinc minerals such as hemimorphite, smithsonite, and goslarite.

Similar Occurrences:

Sinking Valley, Pennsylvania; Mississippi Valley lead-zinc deposits.

Selected References:

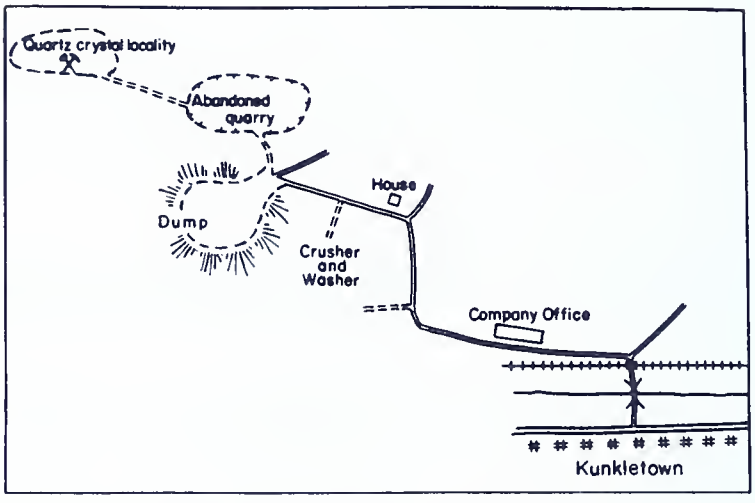
Miller, Benjamin L. (1924), Lead and Zinc Ores of Pennsylvania, Pa. Geol. Survey, 4th Ser., Bull. M 5, pp. 54-84.

Socolow, Arthur A. (1959), Friedensville Mine, Pennsylvania, Geol. Soc. Am. Guidebook.

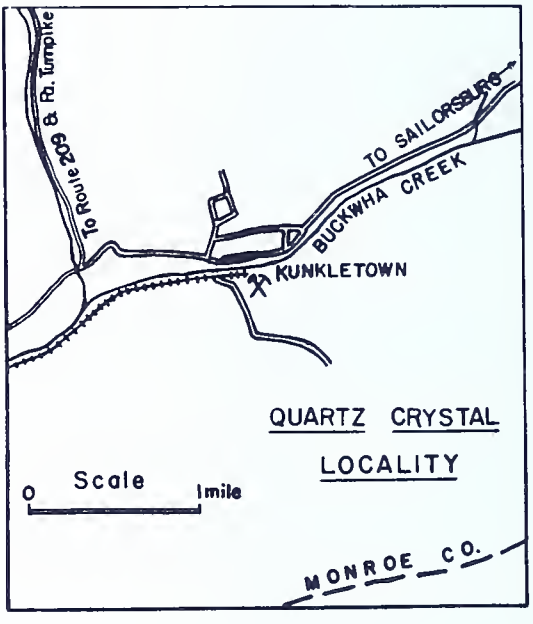
MONROE COUNTY

Kunkletown: Quartz Crystal Mineral Locality

Location:



The Kunkletown quartz crystal locality is located just south of town; in the west-central rectangle of the Wind Gap quadrangle. The crystals may be found throughout the area but the best collecting is in an abandoned clay pit to the east of the currently operated sand quarries and plant. This clay pit may best be found by following the detailed map of the area given below. Permission to collect must be obtained at the sand company's office before entering.



Minerals:

Quartz: excellent clear, terminated crystals up to several inches in length; some crystals are doubly terminated.

ALLEGHENY COUNTY

Allegheny County; the New Kensington West 7-1/2 minute quadrangle, the east-central rectangle,

11. At the Baltimore and Ohio Railroad cut at Wittmer, about two miles north of Etna, Allegheny County, and along Route 8; the Glenshaw 7-1/2 minute quadrangle, the south-central rectangle. About one in ten concretions contain wurtzite crystals.

Minerals:

Wurtzite (crystals); barite (in concretions); calcite (in concretions); pyrite; chalcopyrite (small tetrahedra); sphalerite (massive cleavages and occasional crystals). Most interesting minerals: Small crystals of wurtzite up to 2 mm. or 3 mm. in diameter; of a brownish-red color; with the forms hexagonal pyramids and rhombohedral (trigonal) crystals; embedded in calcite or barite concretions.

Geology:

The wurtzite, sphalerite, chalcopyrite, and pyrite are found along small fractures or cracks, either in calcite or barite concretions. Most of the concretions are oval, and range from two to five inches in length. The concretions are found in carbonaceous clay-shale lenses above a limestone. The minerals are believed to have formed in the clayey muds of an ancient sea bottom, before these muds became compacted into rock. The wurtzites formed first, followed by sphalerite, pyrite and chalcopyrite, and finally by barite or calcite.

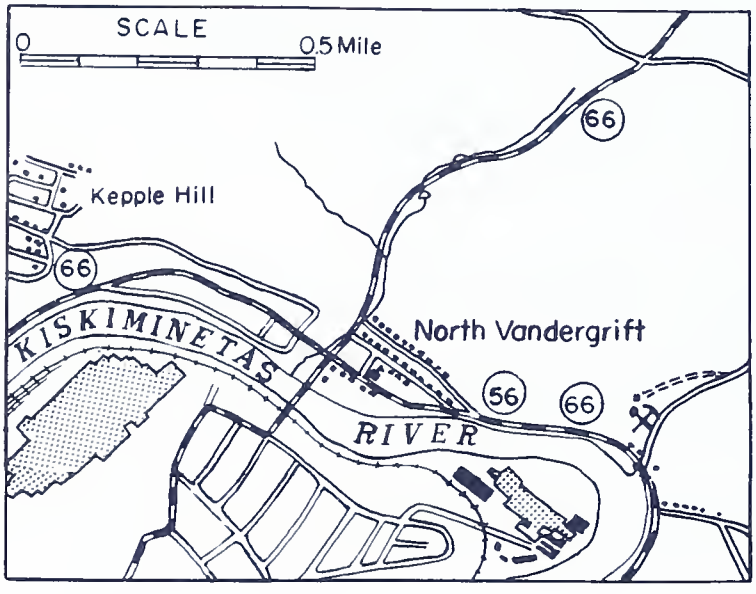
Selected References:

Seaman, David M. and Hamilton, Howard (1950), Occurrence of Polymorphous Wurtzite in Western Pennsylvania and Eastern Ohio, Am. Min., vol. 35, pp. 43-50.

ARMSTRONG COUNTY

North Vandergrift: Galena Mineral Locality

Location:



The galena locality near North Vandergrift is located in the stream bed of Gravel Bar Hollow; just north of the confluence of a small stream with the Kiskiminetas River; in the Vandergrift 7-1/2 minute quadrangle, the north-central rectangle.

Minerals:

Galena (massive); sphalerite (massive, cleavages); barite (massive); all in nodules and concretions.

Geology:

The nodules of barite, containing galena and sphalerite, are found in a limy shale at the base of the Upper Freeport coal bed. The nodules probably formed during the deposition of the limy muds on a sea bottom, before they were compacted into a sedimentary rock.

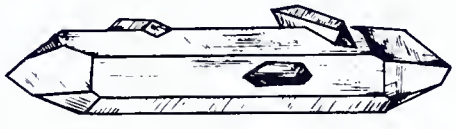
MONROE COUNTY

Geology:

The quartz crystals are found in small vugs and fracture fillings (veins) in a medium-grained sandstone. The individual sand grains in the sandstone are held together by calcite, called a calcite cement. Weathering and ground waters readily dissolve the calcite away, so that the sandstone crumbles and disintegrates easily. Where this has occurred, hundreds of individual quartz crystals and crystal groups may be found loose in the sand. The formation of the quartz crystals was later than the sandstone since the quartz veins cut obliquely across the bedding planes of the sandstone.

Selected References:

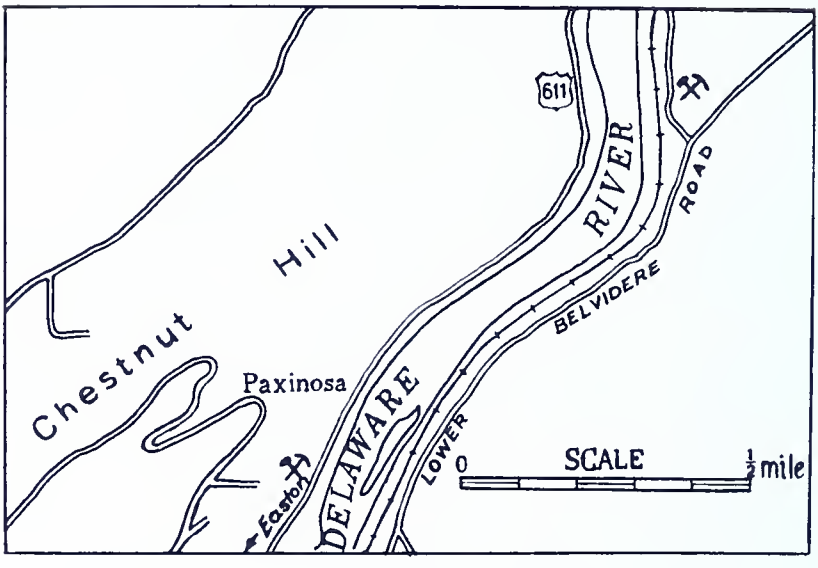
White, I. C. (1882), The Geology of Pike and Monroe Counties, Pa. Geol. Survey, 2nd Survey, Progress Report G 6, pp. 126, 301.



NORTHAMPTON COUNTY

Easton: Serpentine Mineral Locality

Location:



The Williams Quarry is located on the west side of Route 611, 1.3 miles north of the intersection of Routes 22 and 611; in the north-central rectangle of the Easton 7-1/2 minute quadrangle.

The Royal Green Marble Company Quarry is located on the New Jersey side of the Delaware River; on the east side of Lower Belvidere Road; 1.9 miles north of the tollgate on Route 22; also in the north-central rectangle of the Easton 7-1/2 minute quadrangle.

Minerals:

All of the minerals mentioned below occur at the Williams Quarry, while less than half have been noted at the Royal Green Marble Company Quarry.

Common: Tremolite; actinolite; asbestos; serpentine; diopside; augite; biotite; phlogopite; calcite; aragonite; dolomite (pink); talc; bowenite; williamsite; chlorite; graphite; pyrolusite; pyrite; malachite; quartz; orthoclase.

Less common: Autunite; thorianite (high Th uraninite);

uraninite; carnotite; thorogummite; boltwoodite; uranophane; zircon; molybdenite; fluorite; epidote; brucite; strontian calcite; phosgenite; zaratite (very rare); vesuvianite (very rare); vermiculite (?); apatite (very rare); barite; celestite; chalcopyrite; sphene (rare); tourmaline.

Most interesting minerals: the uranium minerals.

Geology:

All of the above minerals are found in a limestone which has been highly altered by solutions and intruded by other rock types. The limestone has been recrystallized into marble. This resulted in the formation of tremolite, phlogopite, diopside, and vesuvianite. It has also been altered and replaced by solutions carrying serpentine minerals. At the Royal Green Marble Company Quarry this has imparted a green color to the marble. At the Williams Quarry, there is very little marble remaining. Almost all of it has been converted to serpentine. Actinolite, serpentine, williamsite, and asbestos are all associated with this stage in the geologic history of this deposit. Following this, the rock was cut (intruded) by acidic solutions rich in quartz and feldspar. These solutions crystallized into a coarse grained rock called pegmatite. The chlorite, tourmaline, celestite, fluorite, uranium minerals, and several other unusual minerals are associated with this phase of geologic activity. Lastly, weathering and ground water have formed brucite, aragonite, malachite, carnotite, and vermiculite by alteration from some of the earlier crystallized minerals. These are generally found along fractures and on open rock surfaces.

Selected References:

Miller, B. L. (1939), Geology and Mineral Resources of Northampton County, Pennsylvania, Pa. Geol. Survey, 4th ser., Bull. C 48, pp. 435-463.

NORTHAMPTON COUNTY

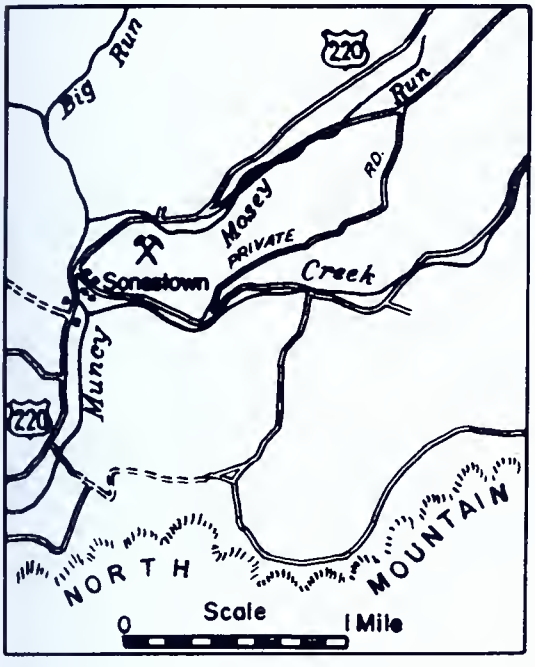
Montgomery, Arthur (1955), Paragenesis of the Serpentine-talc Deposits near Easton, Pennsylvania, Proc. Pa. Acad. Sci., vol. 29, pp. 203-215.

_____ (1957), Three Occurrences of Highthorian Uraninite near Easton, Pennsylvania, Am. Mineralogist, vol. 42, pp. 804-820.

SULLIVAN COUNTY

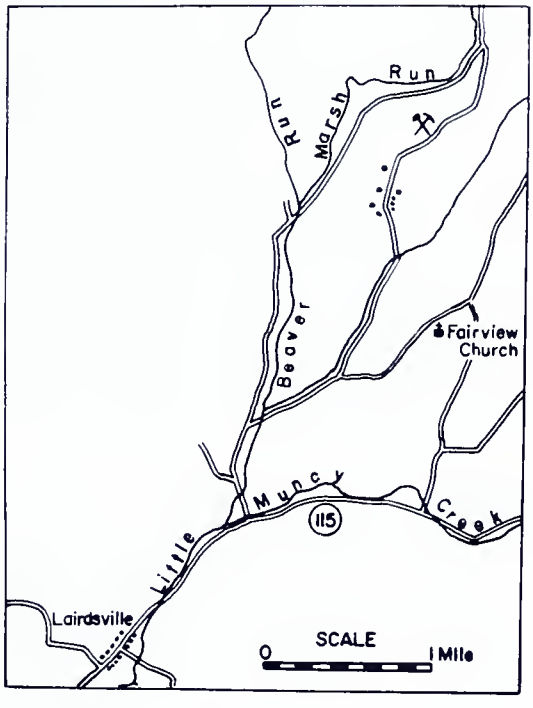
Copper-Uranium Mineral Locality

Location:



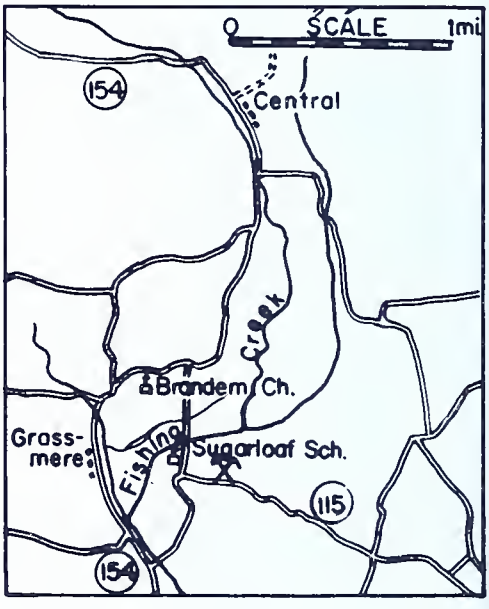
Occurrence #1 - This occurrence is located in the east-central rectangle of the Eagles Mere quadrangle; on Route 220 about 0.5 mile north of Sonestown. Look for a secondary road on the north side of Route 220. Use the presence of this road to find a small driveway directly opposite. Follow this driveway for about 1/4 mile south to a vertical bank which has been partly cleared. The mineralized layer is exposed in this vertical hillside for a distance of nearly 300 feet.

Occurrence #2 - This occurrence is located in Lycoming County; southeast rectangle of the Eagles Mere quadrangle. Take Route 115 east from Hughesville to Lairdsville. At about one mile northeast of Lairdsville, turn north off Route 115 and proceed for 1/2 mile to a fork in the road, and bear right. The road branches again about one mile north of Route 115, bear left.



At about 2.7 miles from Route 115 look for an old abandoned farm house on the north side of the road. An open pit has been dug directly behind the farm house. The uranium bearing layer is on the vertical face of the open pit.

Occurrence #3 - This occurrence is located in Columbia County; south-central rectangle of the Laporte quadrangle. To reach this locality, take Route 154 through Central; turn off this route approximately one mile south of Central and a few hundred feet east of Brandom Church. Follow this secondary road for about 1/2 mile across Fishing Creek and past Sugarloaf School. Just south of Sugarloaf School turn left and proceed for about 1/4 mile. Park near a small pond in the pasture on the right of the road. This occurrence is on the opposite (left) side of the road on the wooded hillside about 1/4 mile from the road. There is no path or roadway to the occurrence. The mineralization can be observed in a trench about 100 feet long and one foot deep. Several small dumps and stock piles are near-by.



Minerals:

Malachite (coatings, flakes), azurite (coatings), chalcocite (massive), and bornite. Also lesser amounts of chalcopyrite, marcasite, barite, chrysocolla, uranophane (rare), metazeunerite (rare), uranospinite (rare), metatorbernite (small flakes), covellite, and galena. Uranium minerals are not visible in hand specimen but are indicated

by radioactivity.

Geology:

The copper-uranium minerals occur as relatively thin, discontinuous lenses or layers which are sandwiched in between great thicknesses of reddish-brown sandstones and shales. The copper-uranium bearing sandstone and shale lenses are distinguished by their gray-green color contrasting strongly with the red layers. The gray-green lenses also contain black fossil plant remains. Copper-uranium mineralization is generally associated with these fossil plant fragments.

Selected References:

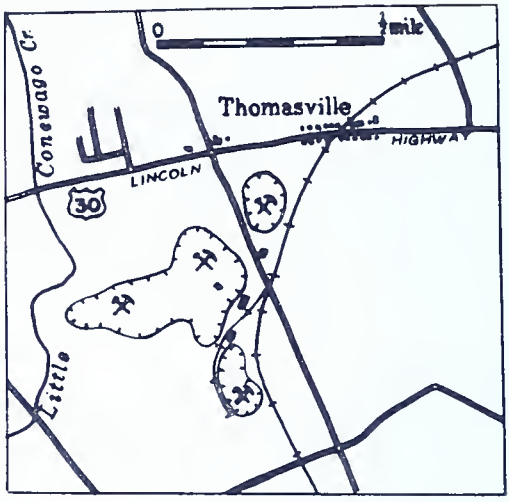
McCauley, John F. (1957), Preliminary Report on the Sedimentary Uranium Occurrences in Pennsylvania, Pa. Geol. Survey, P. R. 152, pp. 1-22.

YORK COUNTY

Thomasville: Calcite Mineral Locality

Location:

The Lincoln Stone Company quarries are located along Route 30, 5-1/2 miles southwest of West York, just south of the town of Thomasville. The area is located in the west-central rectangle of the West York 7-1/2 minute quadrangle. Permission must be obtained to collect on the dumps.



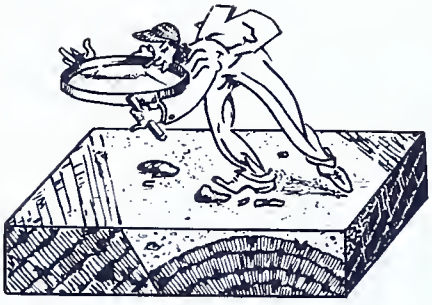
Minerals:

Calcite crystals (modified scaleonhedra up to 14 inches in length, yellow to clear); marcasite (small coxcomb crystal groups); pyrite (small pyritohedra); fluorite (generally massive purple, also on calcite); quartz (small crystals and massive); chalcopyrite (small tetrahedra on calcite); hematite (occasional minute flakes on and in calcite); dolomite (generally massive white and pink); limonite (oxidation product as a surficial coating).

Geology:

The calcite and other associated minerals are found in a sedimentary rock called dolomitic limestone. The high calcium carbonate and magnesium carbonate content of this rock makes it a very suitable geologic environment for the deposition of calcium carbonate crystals in the form of calcite, and calcium-magnesium carbonate crystals as dolomite. Solutions passing through the dolomitic

limestone dissolved some of the rock, and then these solutions redeposited their mineral content as calcite and dolomite crystals along open fractures and in cavities within the rock. The presence of pyrite, chalcopyrite, and fluorite indicate that not all of the chemical elements came from the dolomitic limestone, but that some elements were introduced into the rock, probably by heated (hydrothermal) solutions from depth.



ADDITIONAL READING

Getting Acquainted with Minerals, by George L. English and David E. Jensen; McGraw-Hill Book Company, 330 West 42nd Street, New York 36, N. Y.; 1959; 362 pp.; $6.95.

Gemstones of North America, by John Sinkankas; D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, N. J.; 670 pp; 1959; $15.00.

Gem Hunter's Guide, by Russell P. Macfall; Science and Mechanics Publishing Co., 450 E. Ohio Street, Chicago 11, Illinois; list of about 1000 collecting localities; 1958; $3.95.

Earth for the Layman, American Geological Institute, 2101 Constitution Ave., N. W., Washington 25, D. C.; this publication lists nearly 1400 popular books on geology and related subjects principally for science teachers, librarians, youth, hobbyists, and those who enjoy geologic literature as an avocation; $1.00.

Popular Gemology, by Richard M. Pearl; Sage Books, 2679 S. York Street, Denver 10, Colorado; 1958; $4.00.

Mineralogical Journeys in Arizona, by Arthur L. Flagg; F. H. Bitner Co., Box 1025, Scottsdale, Arizona; 1958; $4.85.

Gem Trails of Texas, by Bessie W. Simpson; Gem Trails, Box 537, Granbury, Texas; 1958; $2.50.

Field Guide to Rocks and Minerals, by Frederick H. Pough; Houghton Mifflin Co., N. Y.; 1955; $3.95.

Rocks and Minerals, by Herbert S. Zim and Paul R. Shaffer; Simon and Schuster, Inc., Rockefeller Center, New York 20, N. Y.; 1957; cloth bound $2.50, paper bound $1.00.

How to Know the Minerals and Rocks, by Richard M. Pearl; McGraw Hill Book Co.; 1955; $3.50.

Rocks and Minerals of California and Their Stories, by Vinson Brown and David Allan; Naturegraph Co., San Martin, California; 1957; $2.75.

Let's Read About Rocks and Minerals, by Kay Ware, Lucille Sutherland, and Valerie Swenson; Webster Publishing Co., Atlanta, Georgia; 1957.

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All About our Changing Rocks, by Anne Terry White; Random House; for younger rockhounds, 10 to 14-year-olds; 1955; $1.95.

Rocks and Minerals and the Stories They Tell, by Robert Irving; Knopf & Co.; for the 8 to 12-year-old group; 1956; $2.75.

Rocks and Minerals, by Richard M. Pearl; Barnes & Noble; 1956; $1.95.

Guide to some Minerals and Rocks in Indiana, S. S. Greenberg, W. M. Bundy, and D. J. McGregor; Geological Survey, Indiana Department of Conservation, Bloomington, Indiana; 1958; $0.25.

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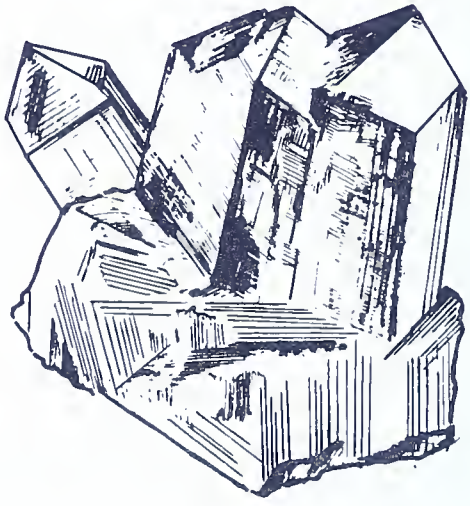

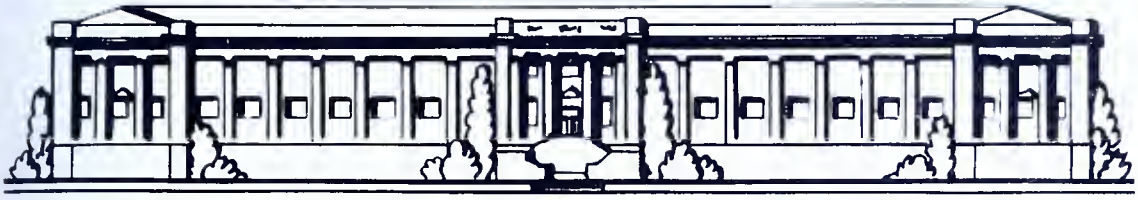

MUSEUMS IN PENNSYLVANIA DISPLAYING ROCKS AND MINERALS

Allegheny College, Department of Geology, Meadville
This college has a small display of rocks and minerals in hall cases.

Bradford County Historical Society, Court Street, Towanda
The museum of the Bradford County Historical Society has a fair collection of minerals and fossils collected during the era of the Second Geological Survey of Pennsylvania (1874-1887).

Bryn Mawr College, Mineral Museum, Department of Geology, Bryn Mawr
The mineral museum at Bryn Mawr College is an excellent one. The minerals are displayed in one large room in well-illuminated glass cases, and in cases throughout the hall. The recently acquired George Vaux collection was one of the outstanding private collections in the eastern United States.

Carnegie Museum, 440 Forbes Street, Pittsburgh
This museum has a large collection of excellent minerals, which is by far the best collection in western Pennsylvania. From time to time, the Carnegie Museum has special displays of gems and spectacular minerals.

Delaware County Institute of Science, Media
The Institute has a nice display of local Delaware County minerals.

Dickinson College, Carlisle

The mineral collection displayed at Dickinson is in new quarters in the Althouse Science Building and is in the process of being assembled.

Erie Public Museum, 356 W. 6th Street, Erie

The Erie Public Museum has a small general collection of rocks and minerals.

Everhart Museum of Natural History, Science and Art, Scranton

(The Everhart Museum is weak on their science collections). The mineralogy and geology collections of the Everhart Museum are small.

Lafayette College, Department of Geology, Easton

The Department of Beology at Lafayette College has a display of minerals in individually lighted glass cases throughout the hallways.

Lehigh University, Department of Geology, Williams Hall, Bethlehem

The Department of Geology at Lehigh University has several large display cases with rocks, minerals, and fossils on exhibit at all times. The display cases are arranged through the halls of the Geology Department building.

North Museum, Franklin & Marshall College, College Avenue, Lancaster

The North Museum in Lancaster has devoted at least one-third of its space to the display of rocks, minerals, fossils, and geologic exhibits. The museum has an excellent collection of local (Lancaster County) minerals.

Pennsylvania University, Mineral Collection, Department of Earth Sciences, College Hall, Philadelphia

The University of Pennsylvania's collection is fair.

Pennsylvania State University, College of Mineral Industries Museum, University Park

Penn State University has an excellent museum of minerals, rocks, and fossils. It is the best in central Pennsylvania. Their mineral collection is displayed in a large room and throughout the halls within the Mineral Industries building.

Philadelphia College of Pharmacy and Science, 43rd, Kingsessing & Woodland Avenues, Philadelphia

The College Museum comprises one spacious room located on the third floor of the college building. There is a small collection of minerals displayed.

Philadelphia Academy of Science, 19th & The Parkway, Philadelphia 3

The Philadelphia Academy has by far the best display of rocks and minerals in eastern Pennsylvania. A large section of the academy is devoted to this display. They have, perhaps, the best representative collection of Pennsylvania rocks and minerals in the State. In addition to large amounts of excellent material, the minerals are displayed very attractively.

Pittsburgh University, Department of Geology, Pittsburgh

The Department of Geology at the University has minerals displayed in hall cases. All-in-all, they have a fair display.

Reading Public Museum, and Art Gallery, 1101 Museum Road, Wyomissing

The Reading Public Museum's mineral collection is general and fair.

State Museum, The Pennsylvania Historical and Museum Commission Building, Harrisburg

The State Museum has a limited one-room display of rocks, minerals, fossils, and plaster models showing local topography and geology.

St. Vincent College Museum, Latrobe

St. Vincent College has a fair collection of U. S. Minerals and a better-than-average collection of European material. In all they have approximately 5,000 mineral specimens.

Tioga Point Museum, 724 S. Main Street, Athens

The museum has a small display of geological material.

Wagner Free Institute of Science, Montgomery Avenue and 17th Street, Philadelphia

The Institute's museum contains permanent exhibits of fossils and minerals. There is also a large study collection of Pennsylvania minerals.

Waynesburg College, Waynesburg

Waynesburg College has a small mineral collection in their museum.

West Chester State Teachers College, Science Museum, Anderson Hall, West Chester

The college posses a representative display of Pennsylvania minerals, many of which were gifts from the Sharpless, Darlington, and other famous collections. A unique feature of the museum is a group of specimens which includes nearly all the minerals to be found in Chester County.

Wyoming Historical and Geological Society Museum, 69 S. Franklin Street, Wilkes-Barre

The museum has a small general collection of minerals.

York County Historical Society, 225 East Market Street, York

The museum of the York County Historical Society is located in the society building at the above address. It has a (fair) general collection of minerals and a small display of local minerals.

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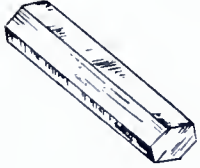

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